Animasia 3-D™

Desktop Animation for the Apple IIGS

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Animasia 3-D

Congratulations on your purchase of Animasia 3-D, the complete animation application for the Apple IIGS. (Animasia is pronounced "Ani-may-zha." The last part sounds like the continent of Asia.) Be sure to fill out and return the registration card so that we can notify you when new versions of this application become available.

This *Tutorial* manual contains an introduction and a dozen lessons to teach you how to use Animasia 3-D to its fullest. The *Reference* manual contains complete information about specific features relating to the Menus, Windows, and Tools. There is also an extra section for using your animations in HyperStudio. Information for using animations with HyperCard IIGS can be found on the supplied disks.

Enjoy!

About Animasia

We at Animasia are dedicated to bringing you software of high quality. Our motto is to sell products that we personally would want to buy and feel comfortable doing so.

Our work is the result of careful planning. Since its inception, Animasia 3-D has been progressively refined for five and a half years. That's no small feat. Our plans are to continue enhancing it in dramatic ways.

Naturally, we take great pride in our work and welcome your feedback. Your questions, comments, and suggestions will help us create a better product.

For fastest communication, contact us electronically on GEnie as *Animasia*, or through the Internet at *animasia@genie.geis.com*.

We can be reached by phone for assistance and technical support at 407-380-9932 10 AM - 4 PM Eastern Time, Monday - Friday.

You can also write to us at:

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Michael Lutynski
President
Animasia
December 10, 1994

About Animasia 3-D

Animasia 3-D is an Apple IIGS desktop application that allows you to create images and animations using three-dimensional (3-D) objects. Animations can be played by Animasia 3-D or included in HyperStudio and HyperCard GS stacks. Animations can be instructive, dramatic, or experimental.

Three-dimensional objects are the things that make up animations. Objects have height, width, and depth, like a chair or a bird. Objects are animated just by moving the object to a new position at a new time. Create the starting and ending positions and the in between transitions are filled in automatically.

Animasia 3-D has a robust suite of features that are powerful, versatile, and intuitive. The goal of all features is to make you more productive when creating 3-D objects, worlds, and animations.

The intuitive interface is what sets Animasia 3-D apart from similar types of software available for other computing platforms. With Animasia 3-D, elements are directly changeable by pointing and clicking the mouse, which conforms to the guidelines published by Apple Computer. You will not have to understand cryptic sets of mathematical concepts and commands. Instead, the popular phrase that heralded the boom of desktop publishing now applies to 3-D graphics: "What you see is what you get."

Animasia 3-D's basic set of tools will be immediately familiar if you have used drawing and painting applications. Rectangle, Oval, Polygon, and Selection tools are operated instinctively. If you are new to 3-D graphics, you will feel accommodated by the interface because advanced features are hidden from view. Power users will appreciate that all commands are just one or two clicks of the mouse button away.

Thirty levels of undoable actions protect you from making mistakes and encourages relaxed experimentation with different options. Having the freedom to revert to virtually any previous state is one of the professional touches that every level of user will appreciate.

Animasia 3-D is compatible with all applications, desk accessories, and extensions, such as AppleWorks GS, Platinum Paint, HyperStudio, HyperCard GS, Switch It!, The Manager, Twilight II, ShadowWrite, HardPressed, AutoArk, GraphicWriter III, Addressed For Success, GNO/ME, and the Finder. To further maximize compatibility, existing file standards are adhered to. For instance, you can export Apple Preferred Format pictures, create Paintworks-type animations, and import industry standard AutoCAD "DXF" type objects. The Clipboard is fully supported and utilized, which makes using Animasia 3-D in conjunction with other graphical applications a strong combination.

While Animasia 3-D is easy to use, it is also powerful. You can cut, copy, paste, move, rotate, size, deform, fuse, align, hide, and lock any object. Tools such as Extrude, Path Extrude, Cone, Bevel, Lathe, Ring, and Spiral create fascinating shapes which invite you to add to and change their appearance.

Indicative of our commitment to bringing high-end features to you at an affordable price, complex structures of objects can be treated as a larger entity using the Link tool. Linking objects together permits parent-child hierarchies to be formed. For instance, a foot is linked to the lower leg, which is linked to the thigh, which is in turn linked to the body. The significance of the linkages is that turning just the body automatically turns the thigh, lower leg, and foot.

3-D worlds with many objects are easily managed using the powerful grouping feature. Groups are similar to what other applications refer to as layers. By hiding a group, all of the objects which belong to the group are also hidden. The result is increased productivity due to less time waiting.

Animasia 3-D views and illuminates its animations using cameras and lights that mimic the real world. Cameras can be interactively positioned and oriented to any place and at any angle. Unlike the real world, the cameras' field of view can be set to view up to 179 degrees and can move instantly from one location to another. Illumination is achieved using an unlimited combination of four types of lights: Ambient, Directional, Radial, and Spotlight. Any light can be colored and spotlights can have a variable cone of light. Cameras and lights can be animated just as easily as any other object.

A full-featured, event-based timeline allows you to fine-tune the timing of your animations. Any one of an object's twelve animatable attributes can be modified independently from each other. Using the acceleration and deceleration feature, objects can animate their actions in a more natural, non-mechanical way.

Animations play back at 30 frames per second by taking advantage of the Apple IIGS' unique "Fill Mode" video. Using this technique, animations are fast, compact, and compatible.

Animasia 3-D was developed with an eye to the future. A prime example is the way it handles colors. While the Apple IIGS can only display sixteen colors at a time, Animasia 3-D internally calculates all colors from a palette of 280 trillion possible variations. Such fidelity is may not seem necessary but it enables Animasia 3-D to automatically mix the sixteen colors to form sixty-four precise shades. There is also a twenty-nine level gray scale mode which displays an object's subtle shading tones.

Whatever it is that you want to animate, Animasia 3-D can do it.

Hardware Requirements

To use Animasia 3-D, you will need:

- An Apple IIGS with at least 2MB of memory. 4MB is recommended.
- Apple GS/OS version 6.0.1. Previous versions will not work properly.
- One 3.5" disk drive. A second disk drive or a hard drive is strongly recommended.
- A color monitor.
- To make printed copies of images, you'll need a printer and an appropriate printer driver.
- Not required but highly recommended is a system accelerator like a Zip or a Transwarp GS. A math coprocessor, like the Floating Point Engine or Number Cruncher will have little effect.

The Keyboard

Keys are referred to by the name printed on them, such as *Return*, *Delete*, *Option*, *Shift*, *Control*, and *Escape*. The key with the hollow apple is referred to as the *Command* key.

The Mouse

Several terms are used to describe working with the mouse:

Clicking means pressing the button on the mouse and then releasing while the mouse remains motionless.

Double-clicking means pressing the button twice in succession.

Command-clicking means holding down the Command key and then clicking the mouse button. Likewise, **Option-clicking** means holding down the Option key, and **Shift-clicking** means holding down the Shift key while pressing the button. You may see **Option-Shift-clicking** which is holding down the Option and Shift keys while pressing the button.

Tutorials

The following sections are lessons on how to use Animasia 3-D. The first tutorial is entitled Quick Start because it shows how to use the main tools right away. The following tutorials illustrate a general feature, such as using the cameras, lights, and aligning functions. You can proceed through the tutorials at your own pace, but you will absorb more if you don't take too much time off in between lessons. The tutorials are:

- Tutorial 1 — Quick Start and Creating Objects
- Tutorial 2 — Object Creation (two parts)
- Tutorial 3 — Sizing, Shaping, and Deforming Objects
- Tutorial 4 — Animation and the Timeline
- Tutorial 5 — Coloring
- Tutorial 6 — Tools
- Tutorial 7 — Object Relationships
- Tutorial 8 — Object Grouping
- Tutorial 9 — Cameras
- Tutorial 10 — Alignment
- Tutorial 11 — Lights
- Tutorial 12 — Animation, Animated Keys, Creating Keys (three parts)

The first four tutorials contain the most information. Once past Tutorial 4, the remaining tutorials will seem much easier.

The tutorials do not cover every single aspect of Animasia 3-D; the little used features won't be described because they can be found in the Reference section. Furthermore, the tutorials do not cover all of the features' options, as this would take too much time.

After you finish with the tutorials, a good strategy would involve reading parts of the Reference section that initially interest you. Since the Reference section is more complete than the tutorials, your understanding of Animasia 3-D's features will be enhanced.

Launching Animasia 3-D

From the Finder, launch Animasia 3-D by double-clicking on its icon. If all goes well, you be greeted by a new desktop. If a dialog box appears with an error message, then steps must be taken to correct the error.

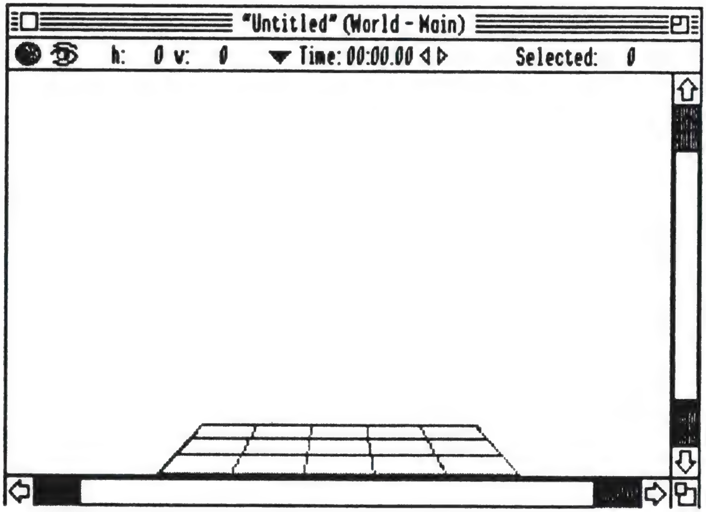
- If a dialog box says that there isn't enough memory, try restarting the computer while holding down the Shift key until the message "No Inits/DAs" appears on the blue splash screen. This prevents unnecessary items from loading into memory. Animasia 3-D requires 2MB of memory to operate, and if there are many extensions loaded, Animasia 3-D won't be able to load. Also, if you have a large RAM disk, you should consider making it smaller.

- If a dialog box says that System Software 6.0.1 is required, then you need to acquire it. Animasia 3-D needs this version to operate properly.

Quick Start & Tutorial One: Creating Objects

When the cursor changes from the wrist watch to the arrow, choose New from the File menu. Two windows will appear.

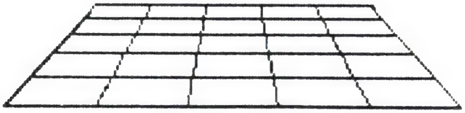
Worlds and Objects



(The World window.)

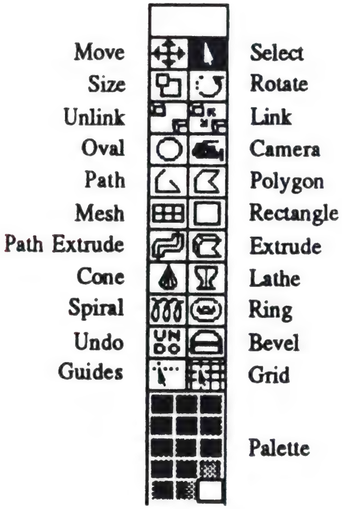
The World window is the large window occupying most of the screen. It is where you will be creating, editing, and animating your *objects*. An object is a thing that has height, width, and depth, like a chair, or a bird. It is anything that has shape.

The Ground



The gray grid at the bottom of the World window is the Ground. It is an object, just like the ones you will be creating, except that the Ground is one of the several standard objects that each world contains. The Ground is used for aligning objects, but aligning won't be covered until a later tutorial. The Ground also serves as a visual reference point in a world that is otherwise a vast void. Without the Ground, you would have a hard time orienting yourself.

Tools



The thin window at the left is the Tools window and contains the tools that you will use to create and modify objects in the World window. You'll also see the color palette at the bottom of the Tools window.

Rectangle Tool

We will create our first object. Look at the Tools window. Find the Rectangle tool. It is on the middle, right side of the window and it looks like a square. Click on the Rectangle tool. It will turn black, meaning that it is the current tool. The Rectangle tool is now *highlighted*. Move the cursor over to the World window. The cursor will change to a cross, which means that the Rectangle tool is ready. To use the Rectangle tool, follow these steps.

Step 1. Click and drag the mouse in the middle of the World window. A rectangle will follow your movements.
Step 2. Release the mouse button when the rectangle is medium-sized.
Step 3. You're done.

You have just created your first object, which is a rectangle. You may notice that the rectangle's four sides appear dotted. This is normal and means that the object is *selected*. Objects have to be selected for the other tools to work with them. For now, don't worry about selections.

Aside from the object being selected, not much more can be said about it except that it's flat and ordinary. We will make it more interesting in a few moments.

Rotate Tool

(For the next step, make sure that your Caps Lock key is up. This key is used as a shortcut to change the actions of the next tool we will be using; we don't want to do the shortcut. A later tutorial will fully discuss the shortcuts.)

Go back to the Tools window. Click on the Rotate tool to highlight it. It is the curved arrow in the upper, right-hand corner of the Tools window. Move the cursor back over to the World window. The cursor will appear like a curved arrow, indicating that the Rotate tool is ready. To use the Rotate tool, follow these steps:

Step 1. Click anywhere inside the World window and drag the mouse.
Step 2. Release the button when done.

What happened? You should've seen a green outline of your rectangle rotating around as you moved the mouse. Did you notice that when you moved the mouse left and right, the rectangle would rotate left and right? And when you moved the mouse up and down, the rectangle would rotate up and down? The Rotate tool simply rotates any selected object.

If you're curious, you may have wondered how to rotate the object clockwise or counterclockwise. A shortcut is to hold down the Control key while clicking and dragging. Try it. Also, holding down the Shift key while dragging constrains the rotation to either a left/right or up/down manner.

Extrude Tool

Let's add some depth to the flat rectangle object. Go to the Tools window and click on the tool directly underneath the Rectangle tool. It is the Extrude tool and when you click on it, it performs an immediate action. Try it. What happened? The rectangle expanded into a three-dimensional box. (If you didn't see a change, use the Rotate tool to rotate the object around.) The Extrude tool extends *surfaces* outward to give the surface depth. A surface is a flat shape that is part of an object. The newly extruded object now has six surfaces. (All boxes and cubes have six surfaces.) Try using the Rotate tool again if you haven't already done so to rotate the box around.

Cone Tool

Let's add to the box. Click on the Select tool in the upper right-hand corner of the Tools window; it looks like the standard arrow cursor. The Select tool selects objects if you click on an object, or it unselects all objects if not clicked on any object.

Since our box object has been selected since the time it was first created, we don't need to select it again. However, we will want to select one of the box's surfaces. Position the tip of the arrow cursor in the center of one of the box's surfaces. Hold down the Command key and click and release on the chosen surface. A green outline will appear to surround the surface, which signifies that the surface is selected. (If you don't see a green outline, try again, but be sure that the box is selected and hold down the Command key while clicking on a surface.)

With the surface selected, go to the Tools window and click on the Cone tool; it looks like a pyramid. The Cone tool performs an immediate action when clicked. What happened? The selected surface was made into a pyramid, or cone shape. The Cone tool works exactly like the Extrude tool except that we had to tell the Cone tool exactly which surface to change. You don't have to select a surface if an object only has one surface, but since the box object had six, we had to select one. (For instance, at the time the Extrude tool was used, there was only one surface that the Extrude tool could possibly extrude.) Try selecting other surfaces on the object and clicking on the Cone tool. Try selecting other surfaces and using the Extrude tool. Animasia 3-D allows an object to have an unlimited amount of surfaces.

Undoing Mistakes

If at any time you've made a mistake and want to go back, choose Undo from the Edit menu. Alternatively, you can click on the Undo tool in the Tools window; they both do the same thing. There are thirty levels of undoable actions, which means that you can experiment with thirty different actions and still be able to revert back to your first step. Try undoing a few of your actions by choosing Undo from the Edit menu.

Move Tool

How would you move the object to another part of the World window? Click on the Move tool, which is to the left of the Select tool; the Move tool looks like four arrows. Go back to the World window. Click anywhere and drag the mouse. You will see a green outline of a box follow your movements. Moving the mouse up and down moves the box up and down. Likewise, moving the mouse left and right moves the box left and right. Release the button to stop moving.

If you're thinking one step ahead, you may be wondering how to move the object away from or towards you. The Move tool has a shortcut: hold down the Control key while clicking and dragging the mouse. Try it. Also, holding down the Shift key while dragging constrains the movement to either a left/right or up/down manner.

Size Tool

The four main tools you will be using the most often are the Select, Move, Rotate, and Size tools. We've covered the first three so we'll introduce the Size tool. First ensure that the object is selected in the World window. Remember to use the Select tool to select objects. Next, highlight the Size tool by clicking on it; it is to the left of the Rotate tool. Click anywhere in the World window and drag the mouse. What happened? Selected objects stretch and shrink according to your movements. Moving right and up makes the objects wider and taller. Moving left and down makes the objects thinner and shorter.

If you're wondering how to size the object in a in/out direction, you hold down the Control key while clicking and dragging the mouse. Try it. Also, holding down the Shift key while dragging constrains the sizing to affect either the width or the height, but not both.

The Modifiers

In general, holding down the Control key modifies the Move, Rotate, and Size tools to make the tool work in an in/out direction instead of up/down and left/right. The Shift key constrains the action of the tool to only one direction.

Oval Tool

We've used the Rectangle tool to create a rectangle, but how do we create circular objects? Click on the Oval tool. It looks like a circle. Go to the World window and click and drag the mouse. An oval will scale itself according to your movements. Hold down the Shift key while dragging to constrain the oval into a perfect circle. Release the button when the oval is at the desired size. You have just created a flat, oval object. The green, dotted box around it signifies that it is selected. You can rotate the oval object with the Rotate tool, move it with the Move tool, size it with the Size tool, select its surface with the Select tool, extrude it with the Extrude tool, or Cone it with the Cone tool. Try them. If you don't like what you've done, you can always choose Undo from the Edit menu.

Polygon Tool

Let's make some different shapes with the Polygon tool. A *polygon* is shape that has many sides. Click on the Polygon tool in the Tools window; it is right above the Rectangle tool. In the World window, find an open space and click and release the mouse button to begin creating the polygon. As you move the cursor, a line will follow it. Click the button to add more edges to the polygon's shape. You don't have to make anything in particular—a star shape will do. The only rule you must follow is that the polygon's edges cannot cross themselves. To stop making the polygon, press the Return key, click on the first point, or click the mouse in the same location as the previous click. Another object has been made. As with rectangles and ovals, you can rotate the polygon with the Rotate tool, move with the Move tool, size with the Size tool, select its surface with the Select tool, extrude it with the Extrude tool, or Cone it with the Cone tool. Try them.

Select Tool

With many different objects now occupying the world, the proper use of Select tool becomes crucial. You should know by now that to select objects, you first need to highlight the Select tool in the Tools window. Clicking on an object selects the object. Holding down the Shift key while clicking allows more than one object to be selected at a time. If the object is already selected while holding down the Shift key, the object becomes unselected. Clicking repeatedly selects objects that overlap each other. You can also select multiple objects by clicking and dragging a box around the objects.

Objects can also be moved with the Select tool. Simply click on an object, hold down the mouse button, and drag the object to a different part of the window. Try it. The Select tool has a dual purpose: first it selects, and if you continue to hold down the button and drag, it acts like the Move tool.

Coloring Objects

Let's change the color of the objects. So far, they have all been white. First select the objects whose color you want to change. Now, to change the color of the selected objects, simply click on a color in the color palette. Try clicking on the light blue color.

Coloring the Background

If you change the color of an object to black, the object will blend into the background; this is not something to worry about. To change the color of the background, first unselect any selected objects. Then click on a color in the color palette to highlight the color. From the Image menu, choose Set Background Color to make the background the color you've highlighted. As a shortcut, you can Shift-click on a color to set the background's color. (That is, hold down the Shift key while clicking on a color.)

Animation

Now let's create a simple animation with our objects.

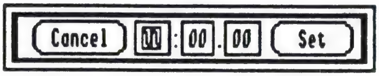
Time

Look to the top of the World window where it says "Time: 00:00.00." This indicates the *current time* in the world. The first pair of zeroes is the *minutes*. The second pair of zeroes is the *seconds*, and the last pair of zeroes is the *frames*, or fractions of a second. Therefore, you would read the current time as "zero minutes, zero seconds, zero frames." In other words, the current time is at the beginning of our animation.

We create animations by advancing the current time and then changing objects with the Move, Rotate, and/or Size tools. Animasia 3-D automatically fills in the in-between positions, orientations, and sizes. It's that simple.

Setting the Time

There are several ways to change the current time, but we'll introduce the most basic way. Click on the current time, or where it says, "Time: 00:00.00." A small dialog box will appear over the current time.



There are three boxes for entering the minutes, seconds, and frames. Click in the middle box and type the number

2. Click on the Set button or press the Return key. The dialog box will go away and the current time will now read, "Time: 00:02.00." We are now at two seconds into our animation.

Animating Objects

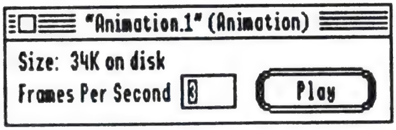
Now that the time is changed, the objects need to be changed. If an object isn't already selected, select an object with the Select tool. Move the object with the Move tool. Select another object and rotate it with the Rotate tool. Select a third object and size it with the Size tool. (Incidentally, you could move, rotate, and size one object—it doesn't matter.) An animation has been created. That wasn't so hard, was it?

Previewing an Animation

To view the animation, go to the Animation menu and choose Animate to Window. A large dialog box will appear. You don't need to change any of its options because its default settings are fine. Click the OK button and watch as the objects animate their position, orientation, and size for two seconds. Don't worry that the animation played out slowly; we will make it play back faster in a moment. Because all the objects had to be computed on-the-fly, the animation wasn't as fast as it could be.

Animate to Disk

What if you wanted to save the animation for future viewing? The answer is to choose Animate to Disk from the Animation menu. Try it. It works almost exactly like the Animate to Window command. The large Animate Options dialog box will appear. Click OK to accept the default options. An additional dialog box will ask for a name to save the animation on disk. Find a disk with about 80K of free space and click Save. The animation will slowly play on the screen, but after it's done, a new window will appear on the desktop.


"Animation.1" (Animation)
Size: 34K on disk
Frames Per Second 8

This is an Animation window. Click on the Play button to play the animation. Notice how much smoother and faster it plays. You can decrease or increase the speed of the animation by pressing the left and right arrow keys. Pressing any other key or clicking the mouse stops the animation and returns you to the desktop.

If you'd like to extend your animation and make the objects do more things, just advance the current time and change the objects with the Move, Rotate, and Size tools. Did you know that you can also animate the color of an object by clicking on a new color in the palette? Try it.

Saving a Project

When you're done, save your world, or *project*, to disk. From the File menu, choose Save. A standard save dialog box will ask you for a name to save the project.

Closing

When we're done working with a project, it's best to close it. While Animasia 3-D can have an unlimited amount of projects open at once, a project can consume a lot of memory. Close the World window by choosing Close from the File menu. Closing the World window closes the project.

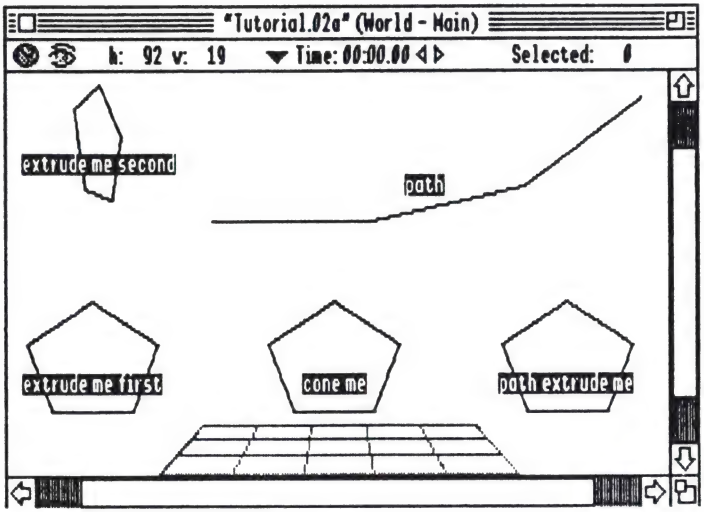
This tutorial lesson was designed to get you started as quickly as possible. The following tutorials introduce new ideas and further explore Animasia 3-D's features.

Tutorial Two, Part A: Object Creation

Objects

Objects are the fundamental things that make up worlds and animations. Included with Animasia 3-D are some objects to help get you started in your collection, but there will be times when you have to create an object because what you want isn't immediately available. Don't worry; creating objects isn't hard. It just takes a little practice. This tutorial shows how to create different shaped objects using the Cone, Extrude, Path Extrude, Bevel, Lathe, Ring, and Spiral tools.

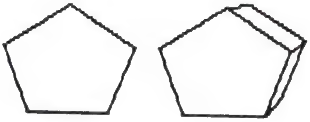
Starting with this tutorial and continuing with all subsequent ones, we will be using pre-made *projects* to work from. A project is basically a world. Go to the File menu and choose Open. The standard Open dialog box will appear. Find and open the folder labeled "Tutorial." Then find and open the file named "Tutorial.02a." After a few moments, a large, black window will appear. This is a *World* window. It is where objects are created, edited, and animated.



Extrude Tool

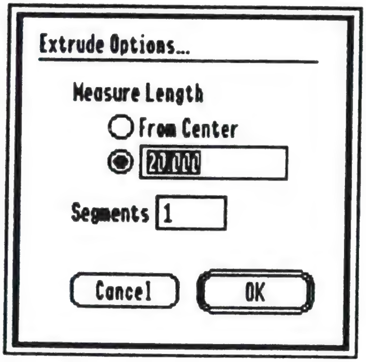
Let us review the Extrude and Cone tools and then learn how to use their options. Remember that the Extrude tool extends an object's surface outward and the Cone tool extends a surface but makes the surface pointed.

First we need to select an object that is to be extruded. From the Tools window, click on the Select tool; it looks like the standard arrow cursor. Now go to the World window and click on the object which says "extrude me first." A green, dotted box will appear around the object, signifying that it is selected. Selected objects are the focus of future actions. Now click on the Extrude tool in the Tools menu. The object's flat shape extends outward to form a solid object.



(At left is the original object. At right is the object extruded.)

How do you determine how far out the shape extends? The Extrude tool, like almost all of the tools, has various options. Command-click on the Extrude tool and a dialog box will appear.



Extrude Options...

Measure Length

○ From Center

● 20.000

Segments 1

The default setting is to extrude surfaces a length of 20. The unit of measurement in Animasia 3-D is abstract, which means that 20 could be 20 inches, 20 centimeters, or 20 meters. However, the implied unit of measurement is inches, so that 20 would be 20 inches. (For international users, an *inch* is equivalent to 2.54 centimeters and a *foot* has 12 inches.) You could change 20 to another number for the length of the extrusion. If you did not know in advance how long the extrusion would be, you can use the From Center option. Let's do an example. Click on From Center and then click on the OK button to set the options.

Extrude from Center

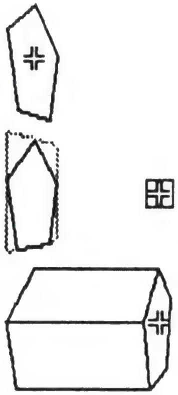
What From Center means will be evident in a moment. Go to the Object menu and choose the Centers item to turn on the Centers option. What you'll see are small markers in the middle of each object that look like plus signs (+). These +'s indicate the *center* of the object, or where the object pivots about when rotated. In the case of the Extrude tool, if the center is moved outward from an object's surface, the length of the extrusion is measured as the distance between the surface and the center. Thus the term "From Center."

Before we can move the center, we have to select the object and then the center. Make sure that the Select tool is highlighted in the Tools window. Now find the object which says "extrude me second" and click on it to select it.

To select its center, Option-click on the +. A small, green box should appear to surround the +. (If not, try again, but be sure that the object is first selected and that you hold down the Option key while clicking on the +.) To move the selected center, follow these steps:

Step 1. Option-click on the + and drag the mouse to the right a medium distance. The small, green box will follow your movements.
Step 2. Release the mouse button.

Now click on the Extrude tool. The surface of the selected object is extruded the exact distance measured between the center and the surface.



(At the top is the original object with its center visible. In the middle is the center moved off to the right. At the bottom is the object extruded to the center.)

Adding to an Object

Remember from the first tutorial that you could add to an object's shape just by selecting a surface and clicking the Extrude tool? Let's try that again. With the "extrude me second" object still selected, Command-click on one of its surfaces to select the surface. A green outline will appear around the surface, signifying that the surface is selected. Click on the Extrude tool. The selected surface is extended from the body of the object.

(At left is the original object. At right is the object with one of its surfaces extruded.)

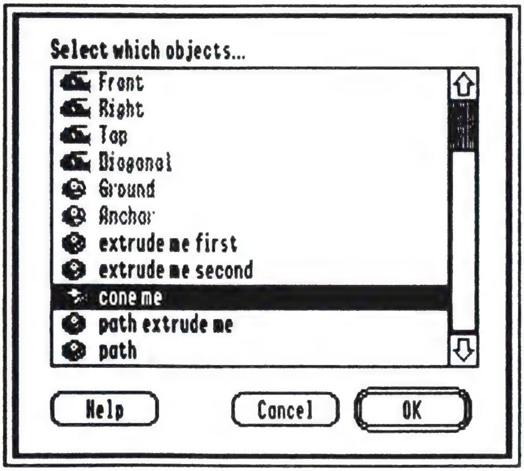
Remember that the Extrude tool is still measuring the distance between the surface and the center for the length of the extrusion. Suppose that's not what we wanted to do. We want to extrude the surface an exact distance of 12 inches. From the Edit menu, choose Undo to restore the object to its previous state. Now Command-click on the Extrude tool to display its options dialog box. Click on the radio button next to the number box and then type in 12 for the length. Click the OK button. With the same surface still selected, click on the Extrude tool. The surface is extruded exactly 12 inches.

Extruding Multiple Surfaces

You can select multiple surfaces and extrude them all at the same time. The trick is to hold down the Shift key while Command-clicking on surfaces. In general, holding down the Shift key with the Select tool selects multiples of whatever it is you're selecting. An even faster way to select all the visible surfaces is to Command-click and drag a box around the object. That is, hold down the Command key, click the mouse outside of the object, and while still holding down the Command key and the mouse button, drag the mouse to the other corner of the object. A green box will follow and outline the area. Any surfaces that fall inside the green box will be selected. Try it.

Select by Name

The Cone tool operates in the exact same manner as the Extrude tool. All of the rules which apply to the Extrude tool apply to the Cone tool. Let's select the object which says "cone me," but not in the normal way using the Select tool; we'll learn a new way to select objects. From the Edit menu, choose the Select By Name item. A dialog box will appear. It presents you with a list of all of the object names. (Many of the names you won't recognize because they haven't been covered yet.)



Select which objects...

From this list, you can select an object solely by its name. Find the "cone me" object name. You may have to scroll down in the list to find it. Click on the "cone me" name to highlight it and then click the OK button. The dialog box disappears and the World window shows that the "cone me" object is selected. In this situation, it would've been easier to just use the Select tool to select the object. But what if the object was very small or entirely out of the window's view? The Select By Name feature would be the only way to select the desired object.

Naming Objects

Consequently, it is important to give your objects meaningful names. From the Object menu, choose the Rename item. A small dialog box will appear with the name of the selected object, "cone me," in an editing box. Change "cone me" to just "cone." Click OK to accept the change. Again, the name "cone me" was acceptable, but consider for example when objects are created using the Rectangle and Oval tools. The default names are generic and uninformative, such as "rectangle 1," "rectangle 2," "oval 5," "oval 6," and so on.

Cone Tool

Now that the "cone" object is selected, click on the Cone tool. As you may or may not have noticed, the Cone (and Extrude) tool will extend the surface away from you. To see the newly coned part of the object, you will want to turn the object around using the Rotate tool. Try it now.

Adding to an Object

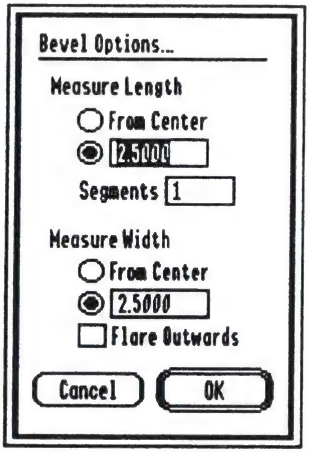
Select a surface on the "cone" object by Command-clicking on a surface. Click on the Cone tool again. The Cone tool can create interesting spiky-shaped objects just by continually coning more selected surfaces.

Bevel Tool

The Bevel tool also performs like the Extrude tool except that the Bevel tool pinches the selected surface inward as the surface is extended from the object. To try the Bevel tool, first select the "extrude me first" object and then select one of its surfaces. Click on the Bevel tool, which looks like a muffin and is to the right of the Undo tool. The selected surface is extended outward but has a chiseled appearance.

Bevel Options

Suppose we wanted a rounded bevel instead of a sharp bevel. The Bevel tool has just such an option. Command-click on the Bevel tool and the Bevel Options dialog box will appear.



Bevel Options...

Measure Length

○ From Center

● 2.5000

Segments 1

Measure Width

○ From Center

● 2.5000

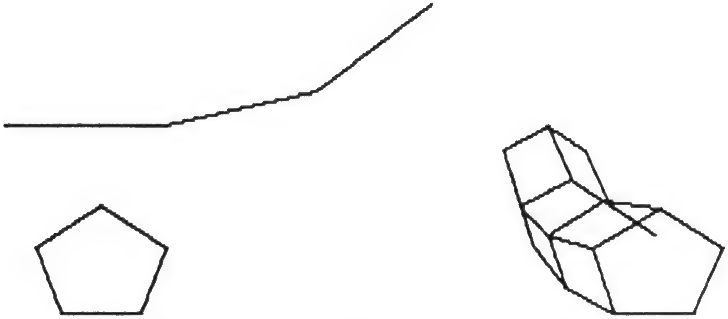
☐ Flare Outwards

In the box next to the word Segments, type the number 4 in place of the number 1. Segments refers to the amount of sections of the bevel; the more segments, the rounder the bevel. Click the OK button to set the options.

From the Edit menu, choose Undo to revert the "extrude me first" object to its prior state. The previous surface is still selected so all we have to do is click on the Bevel tool to bevel the selected surface. Notice that the bevel is rounded and not a hard, chiseled shape. The Bevel tool is useful for adding a chiseled or rounded character to an object's surfaces.

Path Extrude Tool

The Path Extrude tool is used to create pipe-shaped objects. It works like the Extrude, Cone, and Bevel tools except that the Path Extrude tool extends a surface along the direction of a given path. To use the Path Extrude tool, you have to select the object and surface you want to extrude, and you have to select a path. With the Select tool, click on the "path extrude me" object to select it. Select the "path" in addition to the "path extrude me" object by holding down the Shift key while clicking on "path." (Remember that the Shift key allows multiple things to be selected.) There should be two objects selected. You can verify the number of objects selected by looking at the upper right-hand corner of the World window. It should say, "Selected: 2." Now click on the Path Extrude tool. It is to the left of the Extrude tool. The surface of the "path extrude me" object is extended outward and has the shape of the path. The Path Extrude tool is also additive in that you can select any surface on an object and the surface will extend along the direction of the path. (Remember to select the path as well.) Try it. Select another surface on the "path extrude me" object and click on the Path Extrude tool.



(At left are the path and the object to be path extruded. At right is the object path extruded.)

Path Tool

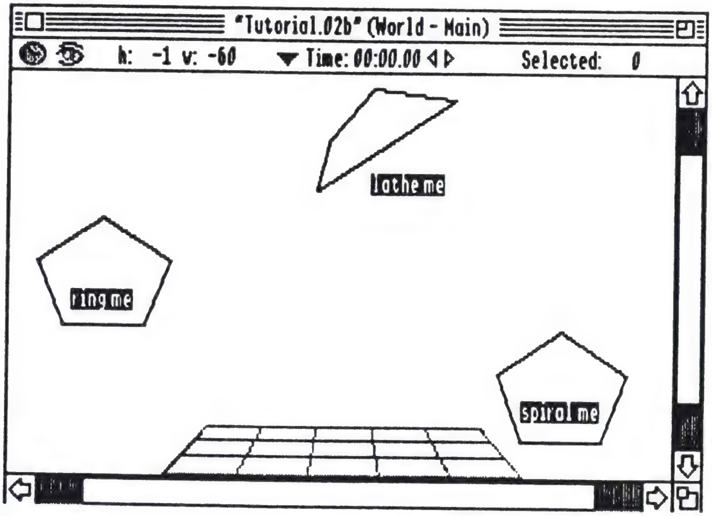
Incidentally, if you're wondering how to create paths, there's a tool designed just for that task. It's called the Path tool and it's to the left of the Polygon tool. Click on it to highlight the tool and then click in the World window to begin creating a path. Move the mouse and click to create another line segment. To finish the path, press the Return key, or click in the same spot as the previous click.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Two, Part B: Object Creation

The first part of this tutorial demonstrated the use of the Extrude, Cone, Bevel, and Path Extrude tools. This part will show how to use the Lathe, Ring, and Spiral tools.

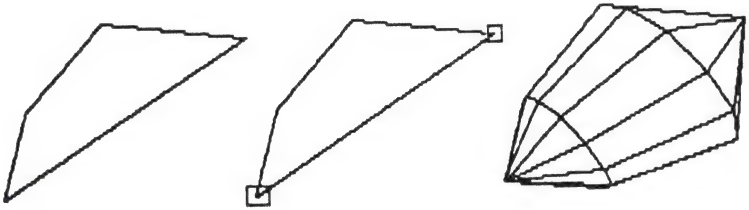
From the File menu, choose Open and find the project file named "Tutorial.02b." Open it and another World window with a different set of objects will appear on the desktop.



Lathe Tool

Lathed objects are round shapes that have a symmetry about its centerline, like a vase. The word lathe refers to a machine tool that turns wood or metal while the operator cuts into the material. Similarly, the same kind of effect is achieved with a potter's wheel where the resulting clay piece has a perfect symmetry. Animasia 3-D can create the same kind of shapes with the Lathe tool.

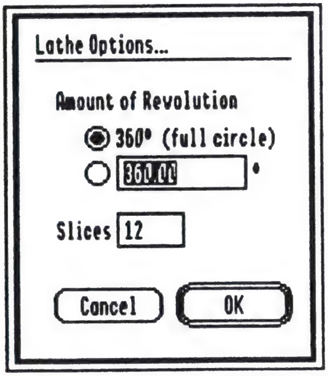
First select the "lathe me" object. Before the Lathe tool can be used, it requires a short preparation. Two *points* must be selected on the object's surface. A *point* is where two edges meet. A point could be called a corner or a vertex, but we will use the term "point." To select a point, use the Select tool and Option-click on the lower left-hand corner, or point, of the "lathe me" object. A small green square should appear over the point if it was selected. (If not, be sure the object is first selected and hold down the Option key while clicking on the lower left-hand corner of the object. You have to be precise when clicking on a point.) To select another point, hold down the Shift key, which allows us to select multiple things, and Option-click on the upper right-hand corner, or point, of the object. Two points should be selected. (If only only one point is selected, be sure to hold down the Shift key when Option-clicking, otherwise only one point will be selected.) Now click on the Lathe tool, which is below the Extrude tool. What happened? The edge of the object spun around the centerline formed by the two selected points. The object is now a round solid. You may want to rotate the object around so you can see how perfectly round it is.



(At left is the original "lathe me" object. In the center is the object with its two points selected. At right is the lathed object.)

Lathe Options

Suppose we only wanted to create a shape that was half of a circular lathe. The Lathe tool has an options dialog box and it is accessed by Command-clicking on the Lathe tool. Try it now.



Lathe Options...

Amount of Revolution

● 360° (full circle)

○ 360.00 °

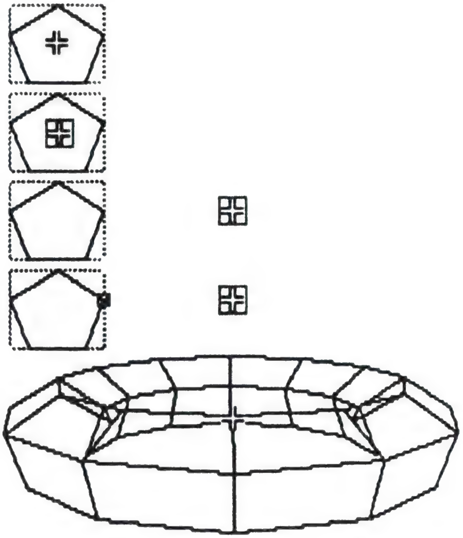
Slices 12

Click on the radio button next to the number box and type 180 in place of the 360. The Lathe tool measures the amount of its circular revolution in degrees (°). 360° equals one circular revolution. Therefore 180° equals half of one circular revolution. Slices indicates how many wedges will fill out the lathed shape. A small number, like four, results in an angular lathed shape, while a larger number, like 36, results in a smooth shape. The number of Slices can be left alone. Click OK to set the options.

From the Edit menu, choose Undo until the "lathe me" object is at its pre-lathed state. Now click on the Lathe tool. The object has a half-rounded appearance because we told the Lathe tool to revolve the surface only 180°. You will have to rotate the object to see the flat side.

Ring Tool

Ringed objects are shapes that look like a donut, or ring. Let's make one using the object named "ring me." First select "ring me." The Ring tool requires a short preparation. It needs a way of knowing how wide the resulting ring will be. We use the object's center to determine the width, or the radius, of the ring. Follow these steps:



Step 1. From the Object menu, choose the Centers item so that the objects' centers become visible.

Step 2. Select the center by Option-clicking on it.

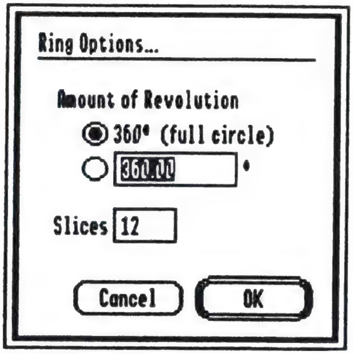
Step 3. Now Option-click and drag the center outside of the object, moving off to the right.

Step 4. What remains is to select just one of the points on the object's surface. Option-click on a point, such as the rightmost one. The distance between the center and the one selected point determines half the width, or the radius, of the resulting ring.

Step 5. Now click on the Ring tool; it's located below the Lathe tool. The surface is swept around into a ring shape. You may want to rotate the object to get a better view, especially if the ring is so big that it obscures part of the window.

Ring Options

How would you create a quarter of a ring? The Ring tool has options that change the way rings are constructed. Command-click on the Ring tool and the Ring Options dialog box will appear.



Ring Options...

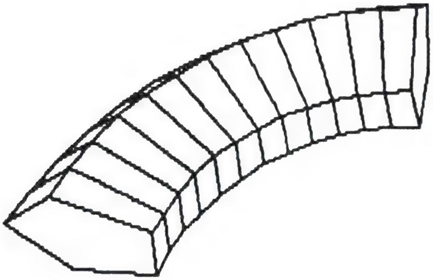
Amount of Revolution

◉ 360° (full circle)

○ 360.00 °

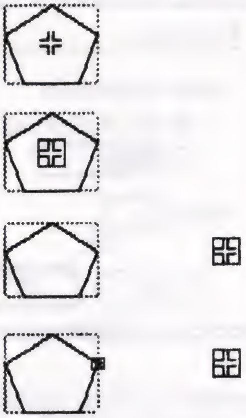
Slices 12

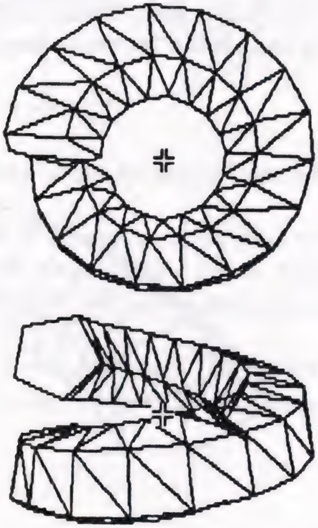
It's options are similar to the Lathe tool's options. Click on the radio button next to the number box and type 90 in the box. The ring will sweep one quarter of a circular revolution, or 90°, instead of a full circle. Click the OK button to set the options. From the Edit menu, choose Undo until the "ring me" object is back to its pre-ring state. Now click on the Ring tool. Notice the ring is only a quarter of a circle. This is an excellent way to create arches.



Spiral Tool

Spiraled objects are shapes that appear like a corkscrew. Let's make one using the object named "spiral me" and the Spiral tool. The Spiral tool requires the same set up as the Ring tool. Select the "spiral me" object and then follow these steps:





Step 1. First check to see that the objects' centers are visible. (There should be a check mark next to the Centers item in the Object menu.)
Step 2. Select the center by Option-clicking on it.
Step 3. Move the selected center outside of the object. (Option-click on the center and drag it out to the left.)
Step 4. Now select one point on the surface. (Option-click on a point to select it, like the leftmost point.) The

distance between the center and the selected point determines half the width, or the radius, of the spiral.

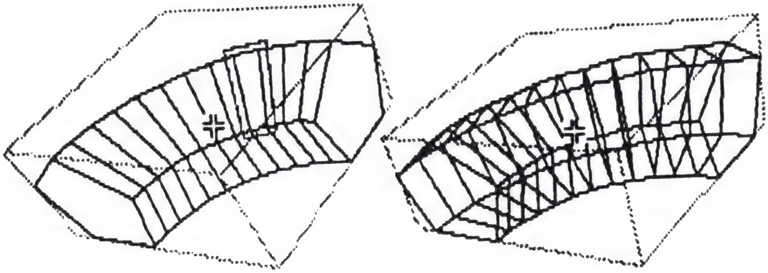
Step 5. Click on the Spiral tool, which is to the left of the Ring tool, to create the spiral. Notice how the spiral shape twists around to form one coil of a corkscrew. You may want to rotate the object with the Rotate tool to get a better overall view.

Deleting Objects

Suppose we had no more need for the "spiral me" object and wanted to get rid of it. Deleting objects is easy. First select the "spiral me" object and only the "spiral me" object. From the Edit menu, choose Clear. The object is removed. You could have also pressed the Delete key to do the same thing.

Deleting Surfaces

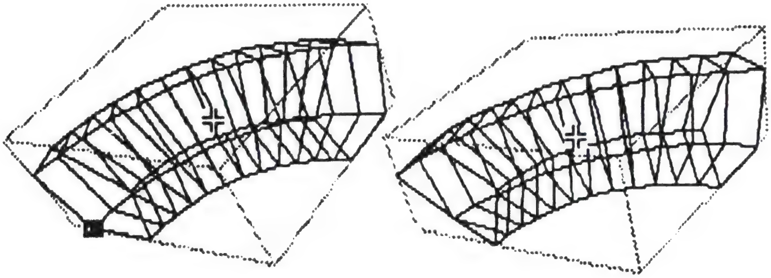
For an object to achieve a desired shape, it is sometimes necessary to trim away parts of it by deleting its surfaces and points. We'll experiment on the "ring me" object. First select the "ring me" object. Now select a surface on the object. To delete the chosen surface, hold down the Command key while pressing Delete. (If you don't hold down the Command key, the entire object will be deleted.) The surface is removed. What we have effectively done is punch a hole in the skin of the object. It is no longer solid but hollow. Hollow objects will show all of the hidden surfaces which previously faced away from us.



(At left, a surface is selected on the object. At right, the surface is removed and the object is now hollow. The hole left by the surface is hard to discern but it is there.)

Deleting Points

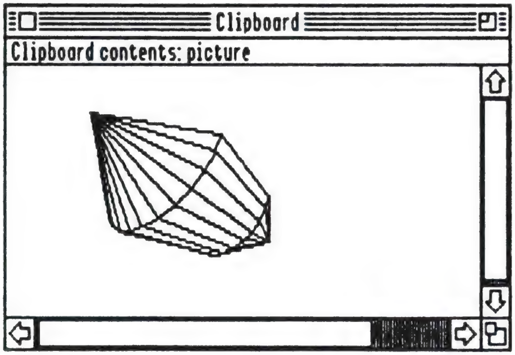
Points can be deleted as well. Select a point on the "ring me" object and hold down the Option key while pressing Delete. The point, and the edges which joined to make the point, are removed.



(At left, the object's lower left-hand point is selected. At right, the point is deleted.)

Copying Objects to the Clipboard

Objects can be duplicated. Select the "lathe me" object and choose Copy from the Edit menu. A copy of the "lathe me" object is now placed in a temporary holding area called the Clipboard. To see the Clipboard and its contents, choose Show Clipboard from the Edit menu. A window will appear with the "ring me" object in it. The Clipboard window is just a viewer and isn't necessary to keep around. Close the Clipboard window by choosing Close from the File menu.



Clipboard contents: picture

(The Clipboard with a copy of the "lathe me" object.)

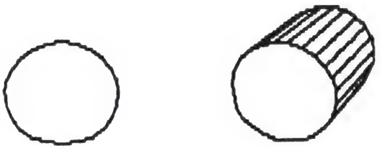
Pasting Objects from the Clipboard

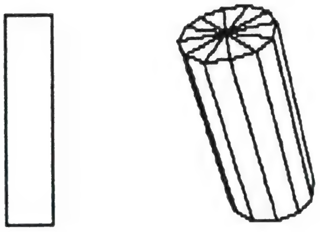
With the World window frontmost, choose Paste from the Edit menu. A copy of the "lathe me" object will be added to the world. The only catch is that the copy is placed in the same spot as the original, which means that you'll have to move the copy to see both at the same time. (There is a reason why the copy isn't offset from the original, and it has to do with preserving the object's position. This will become more apparent in future tutorials.) To move the copy, highlight the Move tool and drag the copy to another place in the World window.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, try the following exercises, or you can continue to the next tutorial. Regardless, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

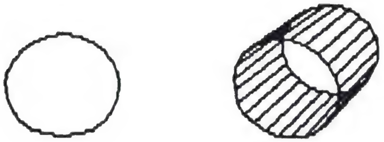
Exercises

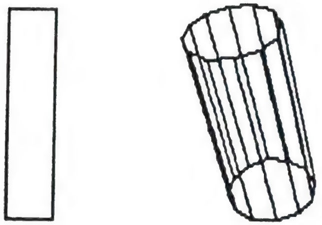
Q: How would you create a tube?
A: With Animasia 3-D, there is usually more than one way to do things. There are two ways you could create a tube.
A1: Use the Oval tool to create an circle object. Click on the Extrude tool to extend the circle into a pipe.
A2: Use the Rectangle tool to create a rectangle object. Use the Select tool to select two consecutive points on one of the rectangle's long sides. Click on the Lathe tool to make the rectangle sweep around into a pipe.



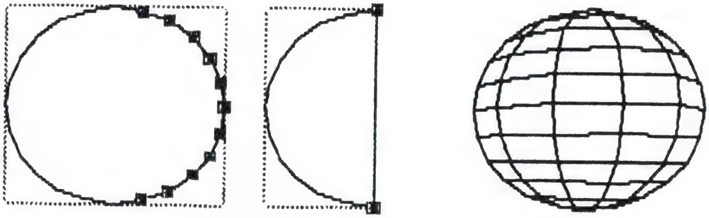


In both answers, the resulting pipe object is solid. What if you wanted to make it hollow on both ends?
A1: In the first case, select the surface on one end of the pipe and delete the surface. (To delete surfaces, remember to hold down the Command key while pressing Delete.) Then select and delete the surface on the other end.
A2: In the second case, you could select all of the small triangle surfaces on each end of the tube and delete them, but there is an easier way. Simply select the single point in the center of the end of the pipe—it's where the triangle surfaces converge. Deleting the point will delete the surfaces which touch the point. (Remember that to delete points, hold down the Option key while pressing Delete.)



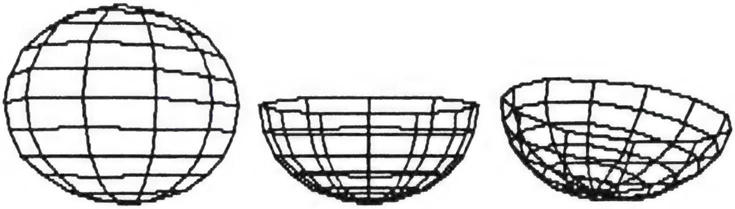


Q: How would you create a ball or sphere?
A: If you haven't figured this one out, that's OK because it's a two step process. With the Oval tool, create a circle object. Use the Select tool to select all the points on one half of the circle. The easy way to do this is to Option-click outside of the circle object and draw a box around half of the object; all the points which lie inside the box will be selected. Delete the points. (Remember again to hold down the Option key when pressing Delete or the entire object will be deleted.) The resulting shape should look like half of a circle. Select the two points on the opposite ends of the long, flat side of the half-circle. Click on the Lathe tool. The half-circle will be swept around to form a ball. If the result is not a complete ball, examine the Lathe tool's options. Command-clicking on the Lathe tool displays the Lathe Options dialog box.



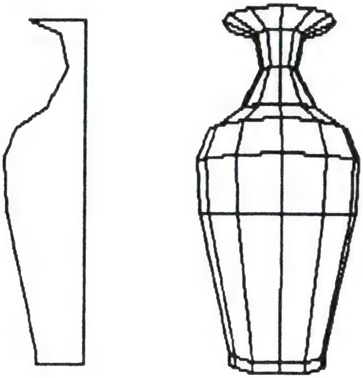
(At left, half of the point are selected, which are then deleted. In the center, the two points on the long end of the half circle are selected. At right, the object is a ball after the Lathe tool is clicked on.)

Q: How would you create a dish?
A: Follow the same steps as described in how to make a ball, but delete the surfaces on the top half of the ball.



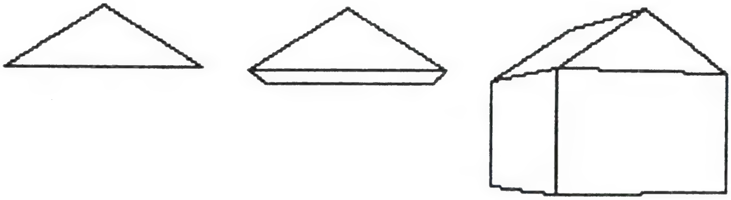
(At left, the ball's top most points are selected and deleted to form the middle and right dish-shaped objects.)

Q: How do you create a vase?
A: Use the Polygon tool to draw the profile of the vase, but draw only one half of the profile. Select the two end points on the flat side of the profile and click on the Lathe tool.



(At left, half the profile of the vase is drawn. At right, the profile is lathed with the Lathe tool.)

Q: How would you create a simple house shape?
A: The easiest way is to start with the roof. Draw the cross section of the roof as a triangle. Extrude the triangle to form a prism shape. Then select the bottom surface of the extruded triangle and extrude that surface to form the walls of the house.

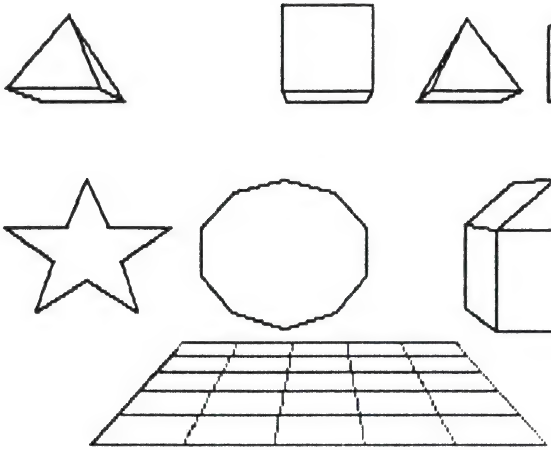


(At left is a triangle. In the center, the triangle has been extruded. At right, the bottom part has been extruded to form the walls.)

Tutorial Three: Sizing, Shaping, and Deforming Objects

When objects are created, they are almost never the exact size needed. More often than not, an object requires a little bit of pushing and pulling to make it the correct size. This is not difficult to do. Objects can be resized to fit a certain dimension, and can be deformed point-by-point to your liking.

Open the project file named "Tutorial.03." It contains objects we will be working with for this lesson.

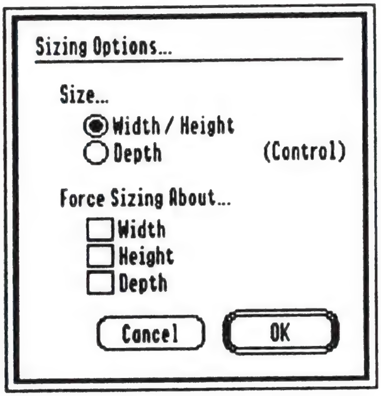


Arbitrary Sizing with the Size Tool

As we've seen from the previous tutorials, objects can be sized interactively using the Size tool. The Size tool is actually a powerful aid. Let's briefly review it. First, select the object named "pyramid 1." Then highlight the Size tool. Click and drag anywhere in the World window to stretch and shrink the pyramid. Moving right or up makes the object wider or taller. Moving left or down makes the object thinner or shorter. Holding down the Control key while dragging makes the object stretch toward or away from you. When you're finished experimenting with the Size tool, choose Reset Size from the Align menu. The size of the object is set to its original size; the original size was determined at the time of its creation.

Size Tool Options

What if you wanted to resize an object uniformly? The Size tool has options that modify the way it works. Command-click on the Size tool and the Sizing Options dialog box will appear.



Sizing Options...

Size...

● Width / Height
○ Depth (Control)

Force Sizing About...

☐ Width
☐ Height
☐ Depth

Click on the three check boxes under "Force Sizing About" for Width, Height, and Depth. When enabled together, these three options force objects to be sized uniformly. Click OK to set the options. Now click and drag using the Size tool as before. Notice how the pyramid is sized uniformly?

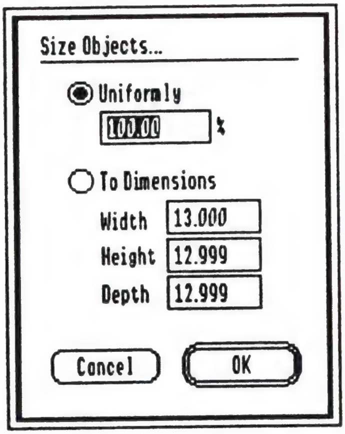
To reset the Size tool's actions, Command-click on the Size tool to display the Sizing Options dialog box. Uncheck the three "Force Sizing About" options and then click OK.

Precise Sizing

Objects can be sized precisely, which is sometimes needed when you want your objects to be *exactly* twice its current size, or you want an object to fit into a certain space.

Uniform Sizing

With the "pyramid 1" object still selected, choose Size from the Align menu. A dialog box will appear.



Size Objects...

● Uniformly

100.00 %

○ To Dimensions

Width 13.000

Height 12.999

Depth 12.999

Since we want to size the object uniformly, click on the radio button next to the word "Uniformly." In the number box below "Uniformly," type 200. This value is a percentage of the object's current size. 200 would then size the object 200%, or two times its current size. (50% would make the object half of its current size.) Click on the OK button to make the change take effect. Notice that the pyramid object is twice as big as it was previously?

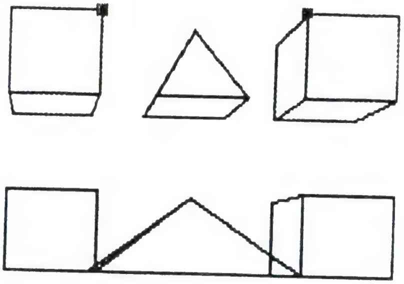
Sizing to Dimensions

How would you size an object to an exact set of dimensions? If you were looking ahead, you would've noticed that the previous dialog box had additional options for setting an object's size. Let's try to resize another object, "pyramid 2," so that it fits exactly within the two blocks to its either side.

First we have to measure the distance between the two blocks. Select the two blocks. (Remember that one way to select multiple objects is to hold down the Shift key while clicking.) To measure the distance between the selected blocks, we will select a corner, or *point*, on each block and then find the distance between the two selected points. Use the Select tool to select a point on each block. (Remember to Option-click on a point to select it.) The gap between the selected points should be as small as possible. (For instance, on the left block, select the front, upper-right point. And on the right block, select the front, upper-left point.)

With the points selected, go to the Align menu and choose Measure Distance. A dialog box will appear telling you the distance between the points; it should be close to 29.3.

Now we can change the width of the "pyramid 2" object to the distance just measured. Unselect the block objects and select "pyramid 2." From the Align menu, choose Size to make the Size Objects dialog box appear. This time, click on the "To Dimensions" word. Below "To Dimensions" are the current dimensions of the "pyramid 2" object in inches. Where it says "Width," type in the distance we had just measured. (29.3.) Click on the OK button to set the size. Notice how the pyramid fits perfectly between the two blocks? Oftentimes, it's easier to create an object quickly and then size it to its exact dimensions than to try to create an object perfectly the first time.



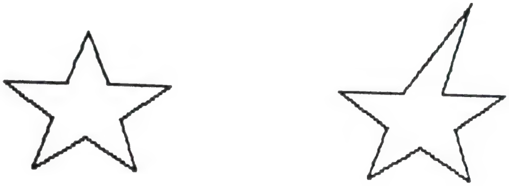
(At the top, the distance between the two blocks is measured. At the bottom, the width of the pyramid is set to the measured distance.)

Deforming Objects

Objects can be reshaped like putty just by dragging its points or surfaces to a new position. This is a powerful feature and it means that you don't have to be settle for the shapes the tools create for you.

Moving Points

Points are moved using the Move tool. First select the "star" object. Now select a point on the star. (Remember to Option-click on points.) Highlight the Move tool. To move the selected point, hold down the Option key first and *then* click and drag the mouse. (It's important to hold down the Option key *before* clicking because holding down the Option key *after* clicking is something else entirely and will be covered in a future tutorial.) Notice how the point follows the mouse's movements? When you release the mouse button, the star is redrawn in its deformed shape. Multiple points can be dragged at one time just by selecting the desired points. The only caveat is that an object can't be turned inside out. There is nothing to prevent you from turning an object inside out, and such a move would needlessly confuse Animasia 3-D concerning future actions with the object.



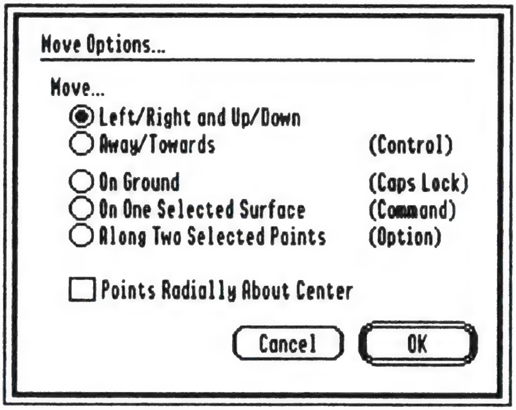
(At left is the original star object. At right, the top point has been moved.)

Moving Points Radially

Animasia 3-D has an interesting feature whereby points can be moved in or out from a central point. For instance, the "star" object was actually created from a circle using the radial moving feature. We will create another star from the "circle" object.

First select the "circle" object. The circle has ten points. We want to select five of them; specifically, we want to select every other point. Select the five points by Shift-Option-clicking on them. (Holding down the Option key selects points and holding down the Shift key allows multiple points to be selected.) If you're having a hard time determining where the points are, it may be easier to select all of the points at once by holding down the Option key and dragging a box around the object. With all of the points selected, you would then unselect every other point by Shift-Option-clicking on each point. These selected points will be moved inward toward the center.

With every other point selected, we need to configure the Move tool. Command-click on the Move tool and its Move Options dialog box will appear.



Move Options...

Move...

● Left/Right and Up/Down

○ Away/Towards (Control)

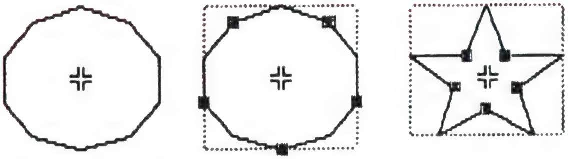
○ On Ground (Caps Lock)

○ On One Selected Surface (Command)

○ Along Two Selected Points (Option)

☐ Points Radially About Center

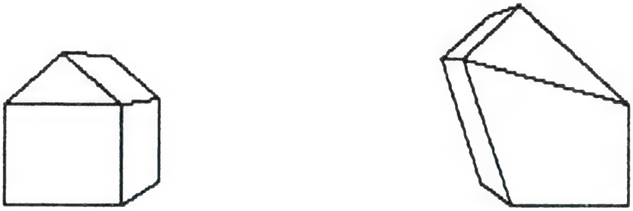
Click on the "Points Move Radially About Center" to check its box. Click on the OK button to set the options. From the Object menu, choose Centers to view all of the objects' centers. Make sure that the Move tool is highlighted. To move all of the selected the points inward, hold down the Option key first and *then* click and drag the mouse. Did you notice how the points moved in and out from the object's center? By moving the points ***radially*** about the object's center, a star shape was made from a simple circle. This star can be used with any of the tools, like Extrude, Path Extrude, Cone, Bevel, Ring, and Spiral. To make a pointy shape such as a star work with the Lathe tool, a few of the star's arms would have to be first deleted.



(At left is the original circle. In the middle, the center is visible and every other point has been selected. At right, the selected points were moved radially towards the center to create a star.)

Moving Surfaces

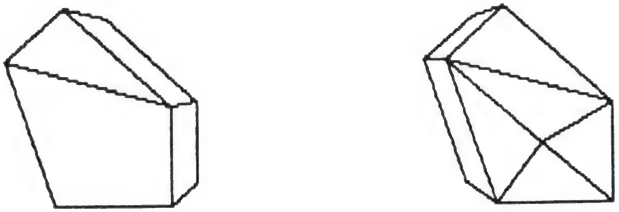
You can also deform an object by dragging its surfaces. First select the "house" object. Now select any surface on the house. (Remember to hold down the Command key to select surfaces.) The radial option is still enabled from the previous example and it needs to be turned off. Command-click on the Move tool, and from its Move Options dialog box, uncheck the "Points Move Radially About Center" option. Click OK to set the options. Ensure that the Move tool is highlighted. To move the selected surface, hold down the Command key first and *then* click and drag the mouse. The surface is moved to a new position.



(At left is the original house object. At right, one of its roof surfaces is moved.)

Deforming and Warped Surfaces

You've probably noticed that when you drag points or surfaces, the adjoining surfaces are affected. For instance, notice with the "house" object that the moved surface stretched the adjoining surfaces. This is important to realize because Animasia 3-D expects its surfaces to be flat and not warped. If a surface becomes warped, most often due to moving points, Animasia 3-D won't know and the warped surface may confuse Animasia 3-D. (A warped surface will not shade itself properly when it is lighted. Lighting will be covered in a later tutorial.) The solution is to ensure that any warped surfaces, before or after the fact, are made flat. The best way is to select a warped surface and choose Subdivide Surfaces from the Object menu. Give it a try. If you don't see any warped surfaces, select any surface. Notice that the selected surface was broken up into smaller triangular surfaces. Triangles are the simplest kinds of surfaces, and because of that fact they cannot be warped no matter how hard you try to deform a triangle's points. Even if a surface isn't warped, subdividing the surface is useful for when a surface needs to be broken up into smaller parts.



(At left is the original object. At right, the front surface has been subdivided into triangles. This is just an example because the front surface was flat and did not need to be subdivided.)

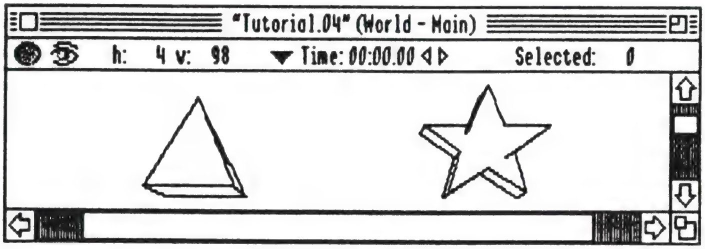
You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. Regardless, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Four: Animation and the Timeline

When you animate your objects over time, Animasia 3-D has to have some way of keeping track of the objects' actions. Animasia 3-D uses a *timeline* to show the objects' actions. The timeline is a separate window from the World window. While the World window displays the objects' shapes at the current time, the Timeline window displays the objects' actions spread over time. The timeline will be introduced shortly.

If you're intimidated by the idea of using a timeline, don't be. You can choose to use Animasia 3-D without having to deal with the Timeline window, but you would be missing much of what makes Animasia 3-D special. You could certainly create animations without ever looking at the timeline, although you wouldn't be able to fine tune your animation. The timeline not only helps you synchronize object actions, but it provides you with a means of checking for mistaken actions, or bugs, in your animation.

From the File menu, Open the project file named "Tutorial.04." A World window will appear at the top of the screen. Resist the temptation to move or resize the window because another window will appear below it later in this tutorial.



h: 4 v: 98 Time: 00:00.00 Selected: 0

Time

Time is important. With Animasia 3-D, everything occurs at a specific time. When you perform certain kinds of actions upon an object, like positioning, rotating, or sizing an object, Animasia 3-D records that action at the *current time*. The current time is displayed near the top, center part of the World window where it says "Time." When a new project is created, the World window's current time is reset to 00:00.00, or at the very beginning of the animation. To read the time, look at 00:00.00 as *minutes : seconds . frames*. It's unlikely that you'll be creating animations that stretch into the hours range, so minutes is more than adequate. Minutes range from 0 to 99, seconds range from 0 to 59, and frames, or fractions of a second, range anywhere from 0 to 29.

Setting the Current Time

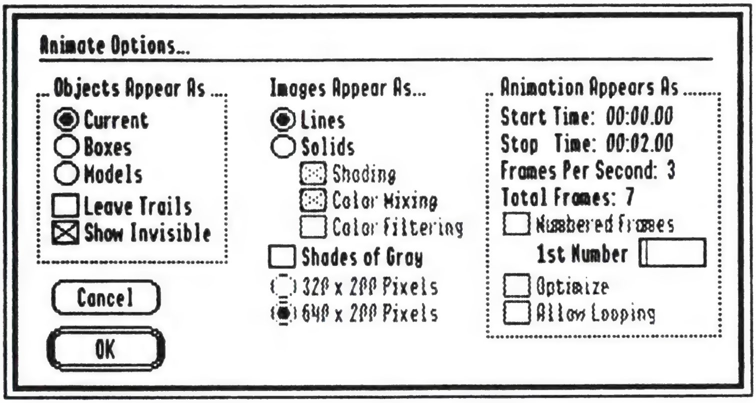
Look at the current time where it says, "Time: 00:00.00." In other words, we are at the beginning of the animation. Back in the first tutorial, we learned one way of setting the time: simply clicking on the word "Time." A dialog box was displayed and we set the time's minutes, seconds, and frames individually. We could do that now, but it's too cumbersome, especially if we will be changing the time often. An alternative way is to click and drag on the downward-pointing black triangle to the left of the word "Time." Dragging the triangle left and right makes the current time go backward and forward. Try it now. Click and drag the downward-pointing black triangle off to the right direction and watch the current time increase. Release the mouse button when the current time reads 00:02.00, which is two seconds. If the time reads anything other than 00:02.00, click and drag the black triangle again so that the time is correct. The current time is now set to two seconds into the animation.

Animation

The way we create animations is to set the time and then change an object. A few of the things we can do to an object is use the Move, Rotate, and Size tools. Select the pyramid. Highlight the Rotate tool and then click and drag to rotate the pyramid to any orientation. We have just made a simple animation: the pyramid's orientation at 00:00.00 will animate itself to the new orientation at 00:02.00.

Viewing the Animation

Let's see the pyramid animating its orientation. From the Animation menu, choose Animate to Window. The Animate Options dialog box will appear.



Animate Options...

Objects Appear As ...
- ● Current
- ○ Boxes
- ○ Models
- ☐ Leave Trails
- ☒ Show Invisible

Images Appear As...
- ● Lines
- ○ Solids
  - ▨ Shading
  - ▨ Color Mixing
  - ☐ Color Filtering
- ☐ Shades of Gray
- ○ 320 x 200 Pixels
- ● 640 x 200 Pixels

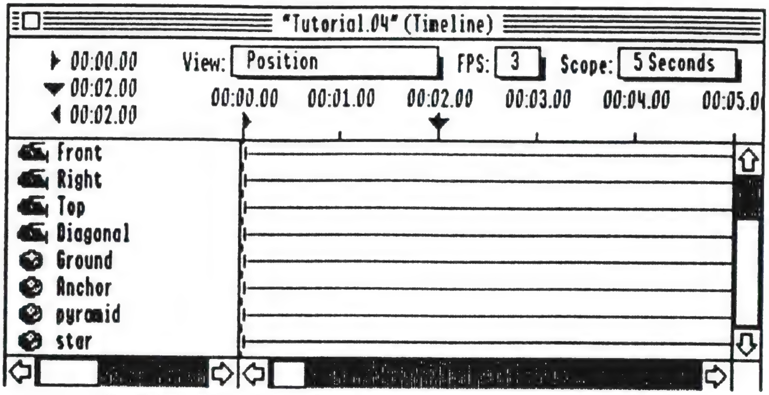
Animation Appears As ...
- Start Time: 00:00.00
- Stop Time: 00:02.00
- Frames Per Second: 3
- Total Frames: 7
- ☐ Numbered Frames
  - 1st Number
- ☐ Optimize
- ☐ Allow Looping

For now, ignore all but the right part of the window where it says "Animation Appears As..." Under that, look at the Start Time and Stop Times. Start Time indicates at what time the animation will begin (00:00.00), and Stop Time indicates at what time the animation will end (00:02.00). FPS is frames per second. Under that is the total number of frames that will be displayed. Click on the OK button to view the animation.

The animation will play out in the World window. Notice that the current time changes frame by frame at the top of the World window. Notice that the pyramid rotates itself to a slightly different orientation at each frame. The pyramid will rotate in the most direct way to its destination. The animation is done when the current time arrives at the Stop Time and the cursor changes from a watch to the normal cursor.

The Timeline

We now know the steps to create a simple animation, but how does Animasia 3-D remember the steps? This is where the timeline comes into play. From the Windows menu, choose the item that says, "Tutorial.04" (Timeline). The Timeline window will appear below the World window. Yes, the Timeline window has more to it than the World window, and it may be a bit intimidating at first, but you'll soon see that it's not so complicated.



"Tutorial.04" (Timeline)

▸ 00:00.00
▾ 00:02.00
◂ 00:02.00

View: Position
FPS: 3
Scope: 5 Seconds

Parts of the Timeline

The box at the lower left shows the names of the objects. Each name has an icon to its left. The icon indicates the kind of object. An object can be a light (light bulb icon), a camera (video camera icon), or a model (cube icon).

The larger box to its right is where the objects' actions, or *attributes*, are displayed. We'll refer to things that can change over time as attributes of an object. This box is mostly empty right now.

Directly over the larger box are times that read 00:00.00, 00:01.00, 00:02.00, 00:03.00, 00:04.00, and 00:05.00. These are the time indicators of the timeline. We know that five seconds of time are displayed because of the time indicators and because at the upper right corner of the Timeline window it says "Scope: 5 Seconds." Let's change the number of displayable seconds. Click on the word Scope and a pop-up menu will appear under the cursor. There is a wide range of time that we could display but we want to only look at two seconds of time. Choose "2 Seconds." Now notice that the time indicators range from 00:00.00 to 00:02.00. We're looking at only the first two seconds of time.

Below the large box and at the very bottom of the Timeline window is a long scroll bar. Click on the scroll bar's right arrow. Notice that the time indicators shift so that the times range from 00:01.00 to 00:03.00. We're still looking at a total of two seconds of time but shifted ahead. Click on the scroll bar's left arrow so that we will again view the first two seconds of the animation (00:00.00 to 00:02.00). Change back the Scope so it reads, "5

Seconds."

The vertical scroll bar on the right side of the Timeline window determines which objects names we can view. Click on the scroll bar's bottom arrow until the last object in the list of names is visible. Specifically, we want to be able to see the names "pyramid" and "star."

Attributes

As was mentioned before, the timeline shows the actions, or attributes, of an object spread over time. What kinds of attributes does the timeline keep track of? Look for the words "View: Position" near the top of the Timeline window. Click on the word View and a pop-up menu will appear under the cursor. You will see a list of the thirteen attributes. The attributes at the top of the menu are the ones you will be working with the most often; the ones at the bottom of the menu will be used least often. The attributes and their meanings are:

- **Position** — The object's location in the world.
- **Orientation** — The object's facing direction.
- **Size** — The object's bigness.
- **Body Color** — The object's color.
- **Visible** — The object's visibility.
- **Light Intensity** — A light object's illumination power.
- **Field of View** — The amount of the world that a camera object will see. Also, the amount of the world a spotlight object will illuminate.

The remaining attributes determine specifically how an object will appear. These are called *material* attributes. These are considered more advanced attributes and can be left alone if desired.

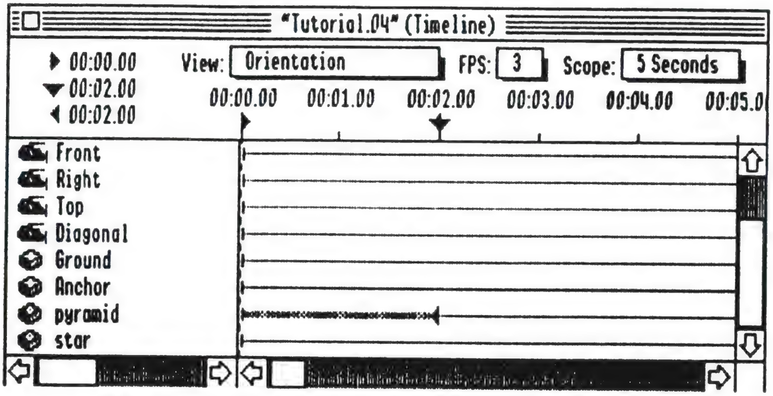
- **Ambient Reflection** — Amount of the Ambient light the object will reflect.
- **Body Reflection** — Amount of the object's Body Color the object will reflect.
- **Highlight Reflection** — Amount of highlight the object will reflect.
- **Highlight Color** — The color of the object's highlight.
- **Highlight Glossiness** — The shininess of the object.
- **Opacity** — The transparency of the object. This is not currently used by Animasia 3-D but is included for future compatibility.

Some of these attributes refer to things we haven't covered yet, like cameras and lights; they'll be covered in future tutorials.

For now, choose Orientation from the View pop-up menu. It should now say, "View: Orientation." As the name View implies, the timeline can only look at one kind of attribute at a time. This is actually a Good Thing because if all the attribute kinds could be seen at once, it would be very confusing.

Attribute Markers and Tweens

Did you notice when you chose the Orientation kind from the View menu that a blue bar appeared next to the pyramid's name? (If not, scroll down to the bottom of the list so that the pyramid's name is visible.)


"Tutorial.04" (Timeline)

View: Orientation FPS: 3 Scope: 5 Seconds

The blue bar extends from 00:00.00 to 00:02.00. At either end of the blue bar are green and red triangle markers, or *attribute markers*. These markers indicate an attribute exists at a particular point in time. For instance, the green maker at the left of the blue bar indicates that an orientation attribute exists at 00:00.00. The red marker at the right of the blue bar indicates that an orientation attribute exists at 00:02.00. (Do not confuse the green and red markers on the blue bar with the green and red markers at the top of the window or at the upper-left corner of the window.)

Tweens

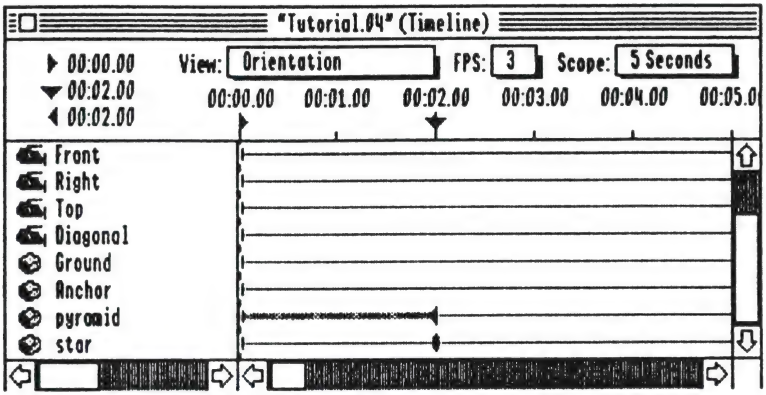
The blue bar is significant. It means that the two Orientation attributes will automatically, and smoothly, change from one to the other as time progresses. The blue bar is called a *Tween* because all of the "in betweens" are computed automatically. You saw the effect that the Tween has when you ran the animation: the pyramid smoothly rotated from one orientation to the other as time progressed. Tweening is a powerful feature because you only have to set the beginning and ending actions and Animasia 3-D will fill in the intervening actions for you. Tweening applies to all attributes, and not just the Orientation attribute. For instance, we could tween an object's position and size, even simultaneously.

The red and green triangles on either end of the Tween have names. The green triangle is called a Start Tween marker, and the red triangle is called a Stop Tween marker. Whenever you'll see a Tween, you'll see these two markers on its ends.

Auto-Tweening

How did Animasia 3-D know to put a Tween between the two attributes at 00:00.00 and 00:02.00? Animasia 3-D used a feature called Auto-Tweening, which we'll be experimenting with next.

To understand Auto-Tweening, follow these steps. The reasoning will be explained afterwards. Make the World window frontmost by clicking anywhere within the World window. Notice that the current time is still at 00:02.00. (If it isn't because you changed it, change it back to 00:02.00.) Go to the Animation menu and look at the Auto-Tweening item. It has a check mark next to it which means that Auto-Tweening is active. Choose Auto-Tweening to uncheck this feature and make it inactive. Select the second object, the "star" object. Highlight the Rotate tool. Click and drag the mouse to rotate the star to any orientation. Remember that we're still at 00:02.00 and not 00:00.00; it's important to keep the current time in mind. When finished rotating the star, click on the Timeline window to make it frontmost.


"Tutorial.04" (Timeline)

View: Orientation FPS: 3 Scope: 5 Seconds

Find the "star" object's name and then look over to its right. You'll see two black attribute markers. The first marker is under 00:00.00 and the second marker, which we just created by rotating the star, is at 00:02.00. Notice that there's no blue Tween bar between the markers. Why? Because we turned off the Auto-Tweening feature. When Auto-Tweening is on, Animasia 3-D creates Tweens for us automatically. Likewise, when Auto-Tweening is off, Animasia 3-D doesn't create Tweens between attribute markers. These black markers are called *Rest* markers because they aren't part of Tweens. A Rest marker indicates that its attribute affects the object until another rest marker or tween comes along.

To see what the effect of having no Tween is like, choose Animate to Window from the Animation menu. Click OK in the Animation Options dialog box to accept the default settings. When the objects animated, did you notice that the pyramid smoothly oriented itself as time progressed from 00:00.00 to 00:02.00 while the star didn't rotate until the time reached 00:02.00? The pyramid smoothly oriented itself because it has a Tween between its Orientation attribute markers. However, the star does not have a Tween and therefore the star didn't rotate until the time reached the next Orientation marker at 00:02.00.

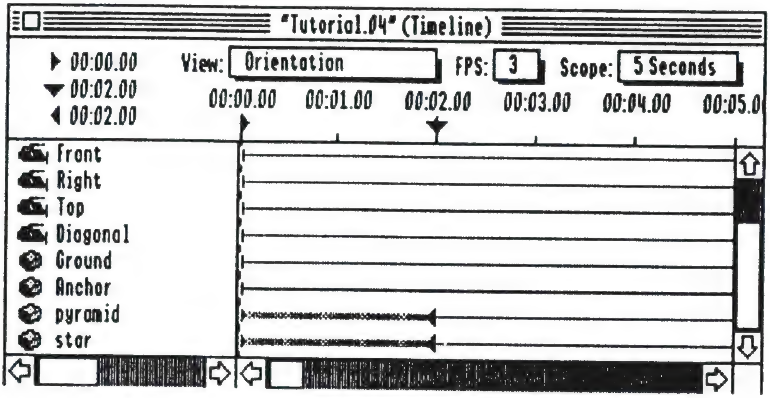
Manually Creating a Tween

What if we later decided that we wanted the star object to animate itself smoothly from the first Orientation attribute at 00:00.00 to the next attribute at 00:02.00? First make the Timeline window frontmost. We will convert the two Rest markers into Start Tween and Stop Tween markers, but before we can do anything to the Rest markers, we have to select them first.

Selecting Attribute Markers

You select markers in the Timeline window simply by clicking on the markers; there is no specific Select tool because the timeline doesn't need one. Selected markers appear bright green. To select more than one marker at a time, hold down the Shift key while clicking on the markers. An easier way to select multiple markers is to drag a box around them. When markers are selected, only the kinds that are being viewed can be selected. In other words, if View says Orientation, then you can only select Orientation attributes and not Position attributes. (There is an exception to this rule and it's explained in the Reference section on the Timeline window.)

Select the star object's two rest markers. (The first of the two markers is at the very left of the box and may be a bit difficult to see because part of it is slightly obscured.) From the Animation menu, choose Tween Attributes. The two Rest markers will turn into Start Tween and Stop Tween markers and a blue Tween bar will appear between the markers. (If nothing happened, be sure to select the star's two Rest markers; selected markers appear bright green.)



"Tutorial.04" (Timeline)

▶ 00:00.00
▼ 00:02.00
◀ 00:02.00

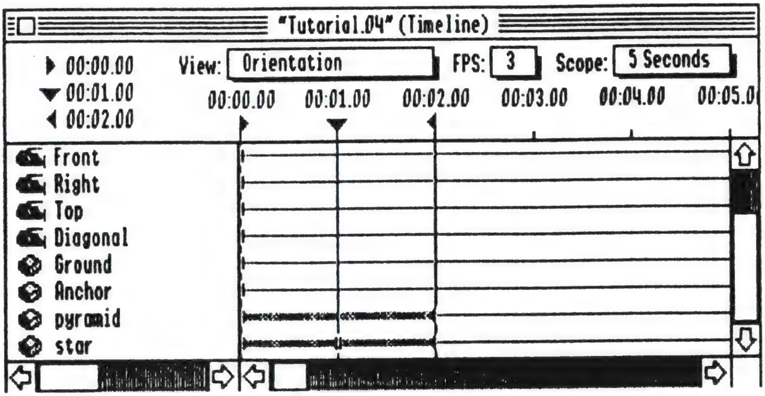
View: Orientation
FPS: 3
Scope: 5 Seconds

A Tween now exists for the star object. To see the effect of the new Tween, choose Animate to Window from the Animation menu. The star now smoothly rotates from one orientation to the other.

Continue Markers

Usually, it's not natural to make objects rotate from just one orientation to the other. What if you wanted the star to rotate to an intermediate orientation before rotating to the final orientation? The timeline uses attribute markers called *Continue* markers to accomplish this task.

We will add a Continue marker to the star. Make the World window frontmost. Set the current time to 00:01.00, or halfway between the two attributes. (There's no rule that says we have to set the time to exactly the half-way point; we could set it to 00:01.02 for instance, but 00:01.00 is clearer.) Select the star if it's not still selected. Use the Rotate tool to rotate the star to a moderately different orientation. For this example to be clear, you don't want to rotate the object too much or it'll be difficult to understand the animated results.



"Tutorial.04" (Timeline)

▶ 00:00.00
▼ 00:01.00
◀ 00:02.00

View: Orientation FPS: 3 Scope: 5 Seconds

Make the Timeline window frontmost again. Notice that with the star there is a new black marker in the middle of the Tween at 00:01.00. This is a Continue marker, and although it looks like a Rest marker, the Continue marker modifies the Tween to take into consideration the new attribute. For instance, a Tween *without* a Continue marker makes the first attribute smoothly blend into the second attribute. However, a Tween *with* a Continue marker makes the first attribute blend to the Continue marker's attribute, and then the Continue marker's attribute blends to the next attribute. A Continue marker gives you a way of modifying the straightness of a tween.

To see the effect of the Continue marker on the Tween, choose Animate to Window from the Animation menu. Notice how the star's orientation tweens. The first orientation tweens to the Continue marker, and then that orientation tweens to the last orientation of the tween. Try it. Seeing it will make more sense than reading about it.

Time Markers

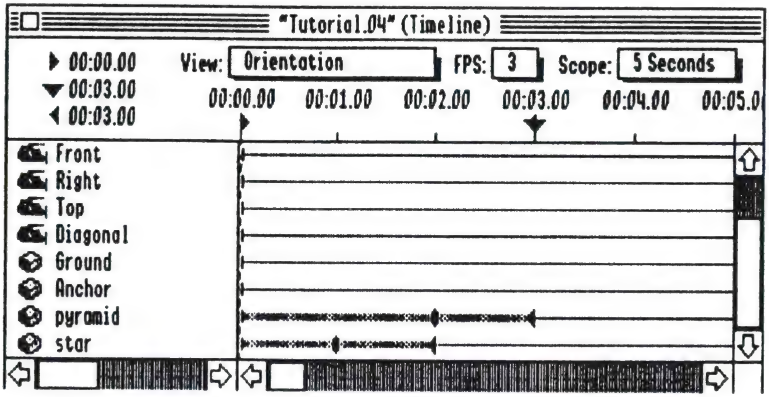
The timeline has three special markers that are used to show where the animation begins, ends, and the current time. Make the Timeline window frontmost. Notice above the large box and just below the time indicators, there are three triangles. Although these triangle markers look like attribute markers, they're not. The green triangle just below 00:00.00 is the Start Time marker and indicates the time at which the animation begins. The red triangle just below 00:02.00 is the Stop Time marker and indicates the ending time. And the black triangle also just below 00:02.00 is the Current Time marker and indicates the current time. If the triangles don't overlap each other, you'll see a line extending down from the triangles and into the large box. These lines are used to help you align your attribute markers to a specific time. In the upper, left-hand corner of the Timeline window are the actual times of the time markers. You'll see the same three triangles but a time will be to the right of each triangle.

Moving the Time Markers

The time markers above the large box can be clicked and dragged to a new point on the timeline. For now, click on the Current Time marker, the black triangle, and drag it ahead one second to 00:03.00. (Don't move the Start and Stop Time markers yet.) Moving the Current Time marker is yet another way to set the current time. The current time in the World window won't be updated to reflect the current time of the Timeline window until the World window is made frontmost. Click on the World window to make it frontmost.

Extending a Tween

What if we wanted to continue the pyramid's Tween so that the pyramid rotated for a longer time, like until 00:03.00? A Tween will automatically be extended if the Auto-Tween feature is enabled. From the Animation menu, choose Auto-Tween to turn this option back on. Select the pyramid object and then highlight the Rotate tool. Again, notice that the current time is 00:03.00—it's a good habit to look at the current time before acting upon an object. Rotate the pyramid.



"Tutorial.04" (Timeline)

▶ 00:00.00
▼ 00:03.00
◀ 00:03.00

View: Orientation
FPS: 3
Scope: 5 Seconds

Make the Timeline window frontmost. Notice the pyramid's Tween. What happened to it? The Tween which previously stretched from 00:00.00 to 00:02.00 has been extended to include the new marker at 00:03.00. The marker at 00:02.00 is still present, but it has been changed into a Continue marker.

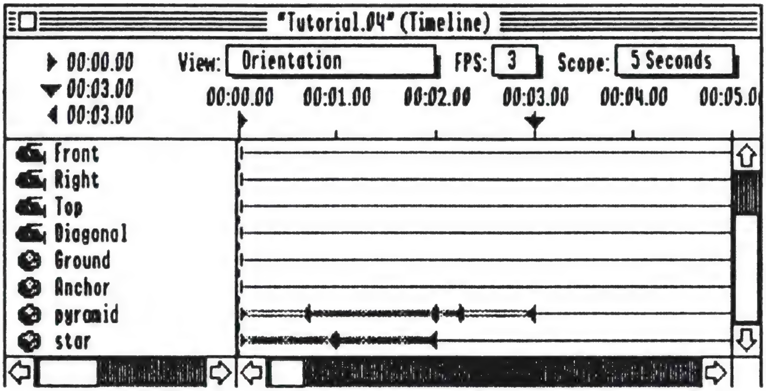
Also, look at the red Stop Time marker above the large box; it has been automatically moved ahead to 00:03.00. Animasia 3-D bumps the Stop Time marker ahead for you automatically so that you don't have to worry about setting the animation's stopping time. However, if you move the Stop Time marker, Animasia 3-D will assume that you want it at a certain time and then will not bump the Stop Time marker again. So, if the Stop Time marker is not at 00:03.00, you must've moved it by yourself, which means you should just move it to 00:03.00

by clicking and dragging it there. From the Animation menu, choose Animate to Window to see the effect of having the pyramid's Tween extended. (Here's a tip: If the Option key is held down while choosing Animate to Window, the Animate Options dialog box will be bypassed.)

Acceleration and Deceleration

Have you noticed that the objects have animated smoothly but at a constant rate? The pyramid and the star begin animating as if they just sprang to life. When they stop animating, it's sudden. It is often more realistic to add acceleration and deceleration to an object so that the object doesn't appear to move mechanically—that is unless you want mechanical movements.

To add acceleration and deceleration to a Tween, follow these steps. First make the Timeline window frontmost. Find the pyramid object's Tween. We want to select the Tween's attribute markers. Simply click on the Tween's blue bar and all of the markers of the Tween will be selected. From the Animation menu, choose Add Accel / Decel to Tween. Acceleration and Deceleration markers are now added to the Tween.

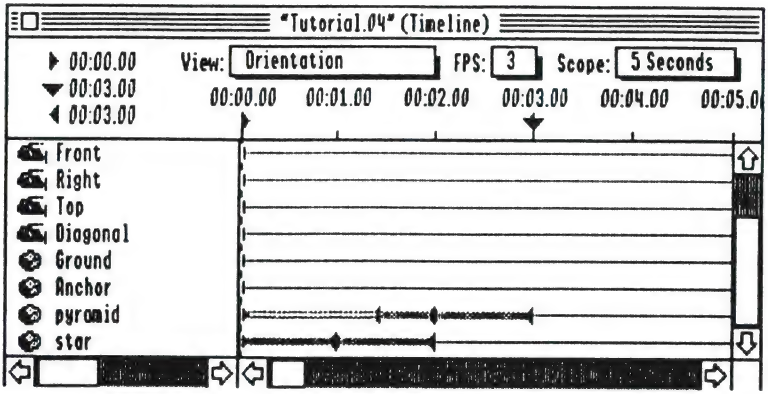

"Tutorial.04" (Timeline)

View: Orientation
FPS: 3
Scope: 5 Seconds

These two kinds of markers appear as thin green and red markers. Acceleration and Deceleration markers, unlike the Start Tween, Stop Tween, Rest, and Continue markers, do not have an attribute associated with their marker; Acceleration and Deceleration markers only speed up or slow down the rate of the Tween.

The Acceleration marker has a white line preceding it and the Deceleration marker has a white line after it. The white lines visually indicate how long the acceleration and deceleration zones will last. Before we animate the objects to see how they look, we should increase the frame rate. Click on the word FPS at the top of the Timeline window. A pop-up menu will appear under the cursor with a list of numbers. These numbers are used to set the *frames per second*, or FPS, of the animation. Choose the number 10 so that our animation will have ten frames for every one second of animation. We want to increase the frame rate so that we can better see the effects of the acceleration and deceleration. Choose Animate to Window and notice how the pyramid slowly starts to rotate, and then before stopping, it gradually slows down.

Make the Timeline window frontmost again. Find the pyramid object's Tween. What if we wanted to make the acceleration last longer? We can move any marker on the timeline simply by selecting the marker and dragging. Click on the Acceleration marker, the one that comes after the first white line, and drag it ahead a little ways. What if we didn't want a Deceleration marker? We can delete markers just by selecting the marker and pressing the Delete key. Click on the Deceleration marker to select it and then press the Delete key. It's gone.



"Tutorial.04" (Timeline)

▶ 00:00.00
▼ 00:03.00
◀ 00:03.00

View: Orientation
FPS: 3
Scope: 5 Seconds

Let's animate the objects again, but this time when the Animate Options dialog window appears, click on the Leave Trails option to enable this feature. Click OK. The objects will animate, but you'll see their trails left behind. This useful feature is an excellent aide for observing precisely how an object is animating. In our case the trails will most likely bunch together because the objects aren't moving around in the world. When the animation is finished, the trails will still remain on the screen. To clear the screen, uncheck Leave Trails in the Animation menu, or choose Redraw from the Image menu.

Other Attributes

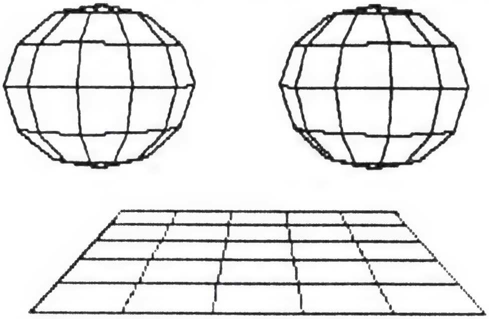
For this tutorial, we've animated only the objects' orientations. We did this for simplicity but there is absolutely no reason why we couldn't have made the objects move and size themselves too. If you want to experiment further with animating objects using the Move and Size tools, then go right ahead. Just remember that before you make any changes to an object, glance at the current time to ensure that it is correct. With the Timeline window, remember to set the View appropriately so that you can see the correct kinds of attributes.

When finished working, close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Five: Coloring

Objects can be made to have any color. The focus of this tutorial is to color objects in two different ways.

Open the project file titled "Tutorial.05." A World window will appear and you will see two white balls.



Changing Colors

When an object is first created, the color of the object is set to be the currently highlighted color in the palette. How do you change the color of the object? Follow these steps. Select the left ball. Click on the pink color in the palette. The ball is made pink. Select the right ball. Click on the bright green color, which is under the pink. The ball is made bright green. Easy enough, right? Good.

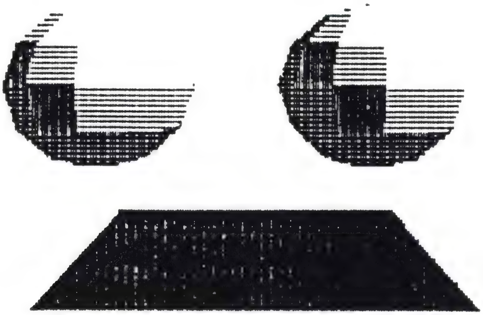
Animating Colors

One thing to note about changing the color of objects is that color can be animated. Color is an attribute just like Position, Orientation, or Size. Try the following. Set the current time to 00:01.00, which is one second into the animation. Select the right ball and click on the dark blue color, which is next to the black. The color of the right ball will animate from a bright green color at 00:00.00 to a dark blue color at 00:01.00.

To see the effects of the animation, we could choose Animate to Window, but there is another way to do the same thing that is faster. First, set the current time to 00:00.00. Now notice the two hollow triangles to the right of the current time. Click on the right triangle. The time advanced by one frame to 00:00.01 and the color of the right ball changed as well. The color changed because we're animating that color change. Click on the right triangle until the time reads 00:01.00 and notice the ball animating its color. Now click on the left triangle to see the color of the object animate from dark blue at 00:01.00 to bright green at 00:00.00. Clicking on the hollow triangles goes to the next or previous frame in the animation.

Display as Solids

Objects can be displayed one of two ways: as lines, or as solids. So far, the objects have appeared as lines. From the Image menu, choose Display as Solids and be prepared to wait anywhere from nine to twenty-nine seconds for the image to redraw itself; the amount of time depends upon the speed of your computer. Don't click the mouse while waiting, because if you do, the click will cancel the drawing and you won't see the final result. If by chance you did click the mouse, choose Redraw from the Image menu.



The two balls appear solid and are illuminated from someplace over your right shoulder. The illumination is the result of a light source, but we won't cover lights until a later tutorial. You can work in the Display as Solids mode just as you do in the Display as Lines mode. But because it takes longer for objects to draw as solids, it's often preferable to work in the lines mode. For example, you could move your objects to different locations, but you would have to wait longer to see the change. That's why Animasia 3-D allows you to cancel the drawing process if it's taking too long. Clicking the mouse, pressing Escape, or pressing Command and Period will stop the drawing and show what has been drawn so far. If nothing has been drawn, you'll see black. Sometimes the mouse button can accidentally bounce twice and the image will stop drawing. If this happens, choose Redraw from the Image menu.

Color Mixing

Let's change the color of the left ball while the balls still appear as solids. Select the left ball and then click on the yellow color in the color palette. Be patient for a few moments and then the left ball will appear shaded yellow. Notice the way the colors on the objects blend together. In particular, the you'll see two colors alternating line over line. This is done to make the image appear as if there are more shades of a particular color. If this blending effect doesn't appeal to you, you can turn it off by choosing Color Mixing from the Image menu. Try it. The image will automatically redraw. As you can see, with fewer colors to choose from, the objects don't look that much better. Turn the Color Mixing option back on.

Shades of Gray

Sometimes even with the Color Mixing option turned on, the objects' color doesn't appear well defined. That is, the shading of the objects isn't subtle. There is a way to see the subtle shading of the objects, but all colors are sacrificed. From the Image menu, choose Shades of Gray to turn on the option. Wait a moment and the image will redraw. The objects appear as a fine tone of grays. Turn off Shades of Gray to revert back to colors.

Surface Coloring

We know that the color of an entire object can be changed just by clicking on a color in the palette. The color of individual surfaces can be changed as well. Changing the color of a surface is desirable if, for example, you had a face object and you wanted to color the lips and eyes differently. Or you could make an object have a checkerboard appearance by coloring every other surface with another color. Select the left ball and choose Surface Coloring from the Appearance menu. After a moment, the left ball will appear white. Why white? When we chose Surface Coloring, we told the object not to use its body color but rather its surfaces' colors. The default color of each individual surface is white. To change the color of a surface, first select a surface. (Remember to hold down the Command key when clicking with the Select tool to select surfaces.) Hold down the Command key while clicking on a color in the color palette. The color of the surface is changed to the color you chose. Because the object is shaded, the color you chose will appear shaded as well. It's important to hold down the Command key when clicking on a palette's color so that Animasia 3-D knows that you want to change the color of the selected surfaces and not the color of the entire object.

To clarify, an object can be displayed two separate ways regarding color. The first is when Surface Coloring is off and the entire object is one color. The second is when Surface Coloring is on and each surface has its own color. While it may seem that the second way is better because it offers more flexibility, the color of the individual surfaces cannot be animated. The first way, as we have seen, can animate color.

Body Color Attribute

When you click on a color in the palette without holding down the Command key, a *Body Color* attribute is created at the current time for the selected objects. This attribute is seen as a marker in the Timeline window, and because it's an attribute, it can be animated. Surfaces don't have attributes and therefore the color of a surface can't be animated.

Shading

What if we didn't want the objects to appear shaded? From the Image menu, choose Shading to turn off the option. In a moment, all of the objects will appear without any shading. Notice that the surface colors of the left object are easier to identify now that there's no shading. Turning off shading also makes the image redraw a little faster because the lighting calculations aren't needed. Finally, choose Display as Lines from the Image menu.

Coloring the Background

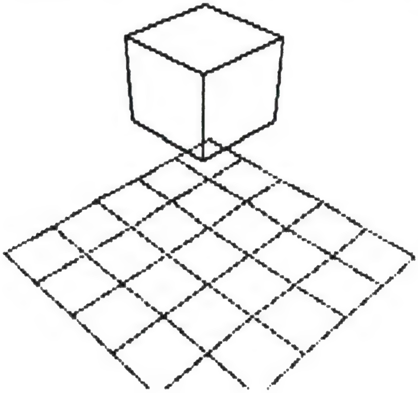
The image's background can be colored but its color can't be animated. To change the color of the background, first unselect any objects. We don't want to have objects selected because we'll be clicking on a color in the palette and doing so would change the selected objects' color. Now click on a color in the palette for which you want the background to appear. Choose a color other than black, like purple. From the Image menu, choose Set Background Color. The background's color changes to purple. Did you notice something unusual? When the color of the background was changed, another object appeared above the two balls. It's a pyramid and it was there all along; we couldn't see it because the pyramid was the same color as the background. A short-cut for changing the color of the background is to hold down the Shift key while clicking on a color in the palette.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Six: Tools

Besides the Select tool, the three most important tools are the Move, Rotate, and Size tools. They're important because they're used the most often, and your success and satisfaction with Animasia 3-D relies upon their mastery. They're not hard to use as we'll soon see, but rather they each have several options which make the tools more productive.

Open the project file named "Tutorial.06." When the World window appears, you'll notice that there is only one object in the view, excepting the Ground, and that we're looking diagonally down on the object. We've shifted the viewpoint purposely so that a few of the tools' options can be better understood. We also won't be creating any animations in this tutorial, but remember that we easily could just by changing the current time and moving, rotating, or sizing the object.



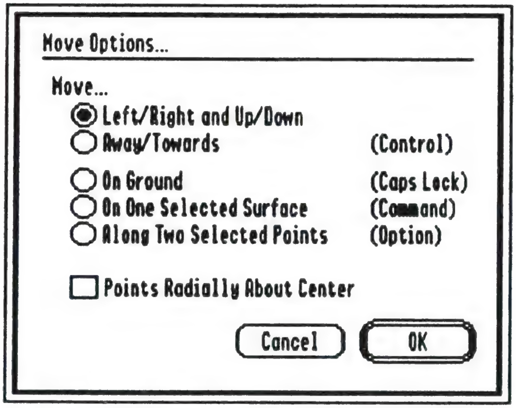
Move Tool

The Move tool has several options which govern the way objects are moved. We'll start by learning its basic features. First select the cube. Make sure that your Caps Lock key isn't pressed; the reason will be clear shortly. Highlight the Move tool and move the object around the world. You may be thinking that you've done this before but there is a point to be made. Try it. Notice how the object moves. It moves naturally, right? When you move the mouse up, the object moves up. What could be more simple than that? Well, exactly which way is "up"? Did the object move straight up *from the Ground*, or did it move straight up *relative to your viewpoint*? It moved straight up relative to your viewpoint. That's an important distinction to understand. Depending upon the viewpoint, moving the mouse "up" may not move the object straight "up" from the Ground. In fact, only when your viewpoint is level with the Ground will moving the mouse up make the object move straight up from the Ground. How do we move objects straight up from the Ground regardless of the viewpoint? We'll cover that in a minute, but let's first do a few more basics.

Moving In and Out

Moving the object only moves it in two directions: left/right, and up/down. To move objects toward or away from you, hold down the Control key while moving the object. Try it now. Again, the object moves in and out *relative to your viewpoint* and not to the ground. The Control key is used consistently with the tools; holding down the Control key makes the tool work in the third direction.

If you don't like having to hold down an extra key while moving objects, you can set an option to do so for you. Command-click on the Move tool and the Move Options dialog box will appear.



Move Options...

Move...

● Left/Right and Up/Down
○ Away/Towards (Control)
○ On Ground (Caps Lock)
○ On One Selected Surface (Command)
○ Along Two Selected Points (Option)

☐ Points Radially About Center

Notice the options under the word "Move." The first option says "Left / Right and Up / Down." That's the option we've been using so far. Click on the option below it, "Away / Towards." Notice to the right of the options are names of keys in parentheses, like "(Control)." These keys indicate shortcuts to active the option without having to go to the Move Options dialog box every time. Click on the OK button.

Now click and drag the mouse without holding down any keys. The object moves away from and towards you. What if we held down the Control key? Try it. With the Control key pressed, the object moves normally in its left / right and up / down manner. Why didn't the object continue to move away from / towards us? Holding down the Control key merely reverses the action of the option in the Move Options dialog box.

Moving on the Ground

Moving objects on the Ground is often necessary when you want to constrain an object's movement to the Ground's plane. Actually, the objects don't have to be *on* the ground, but rather the objects move *parallel* to the ground. Command-click on the Move tool to display the Move Options dialog box again. Click on the "On Ground" option and then click OK.

Try moving the object and see how it responds. The object is constrained to move parallel to the Ground. Now, to get back to our previous question: How do we move an object straight up from the Ground? Hold down the

Control key and move the object. The object moves straight up and down from the Ground, or *perpendicular* to the Ground's plane. So now we see that the Control key constrains objects to move in the third direction of whichever option is being used.

Moving on a Surface

Suppose you wanted to move an object so as to be constrained to a plane other than the Ground. How would you do it? If the object has a surface which is aligned properly, the surface can be used to constrain the object's movement. First select a surface on the object. (Remember to Command-click on a surface with the Select tool to select surfaces.) Next, Command-click on the Move tool to display the Move Options dialog box. Click the "On One Selected Surface" option and then click OK.

Move the object and see how it responds. The object only moves parallel to the selected surface's plane. Try holding down the Control key and moving the object. The object moves perpendicularly to the surface's plane.

Moving Along Two Points

Objects can be constrained to move in one particular direction. This is useful when you want an object to only move one way and not drift another. Although it's not necessary to unselect the selected surface, you can do so; the object will look less cluttered if you do. (To unselect surfaces, Shift-Command-click on the surface with the Select tool.) Now, select any two points on the object. (Select points by Option-clicking on a point. You'll have to Shift-Option-click so that you can select multiple points.) Command-click on the Move tool to display the Move Options dialog box. Click on the "Along Two Selected Points" option. For now, notice that the Option key is the shortcut for this option. We'll be using the shortcut a little later. Click OK.

Move the object and see how it responds. The object can only be moved in the direction formed by the imaginary line between the two points. What happens if you hold down the Control key and move the object? Nothing. Nothing different will happen because the Move tool has no way of knowing what the third direction could possibly be from just two points.

Let's use the Move tool as we just did but with its shortcut. Command-click on the Move tool to display the Move Options dialog box. Click on the "Left / Right and Up / Down" option. This option returns us to the Move tool's normal behavior. Click OK. With the two points already selected, do the next three steps in the following order:

Step 1. Click and hold the mouse button.
Step 2. Then hold down the Option key.
Step 3. Move the mouse.

The object moves constrained along the imaginary line formed by the two selected points. In other words, we just changed the Move tool's behavior by using a shortcut key. Using the shortcuts saves a tremendous amount of time but you do have to be aware of one thing: with the Option and Command key shortcuts, you have to press the shortcut keys *after* you click the mouse button. To demonstrate, do the following steps:

Step 1. Hold down the Option key.
Step 2. Then click an drag the mouse.

What happened? The object's *points* moved instead of the object itself moving. That's the way to move points but we didn't want to move the points. Fortunately, if this happens, you can choose Undo from the Edit menu and then try again. Choose Undo now.

The Select tool has a dual purpose. It selects things, and if the mouse button is held down, whatever is selected will be moved when the mouse moves. This makes the Select tool very handy, although the drawback is that you have to click on whatever it is you want to move before you can move it; with the Move tool, you can click anywhere to move whatever is selected.

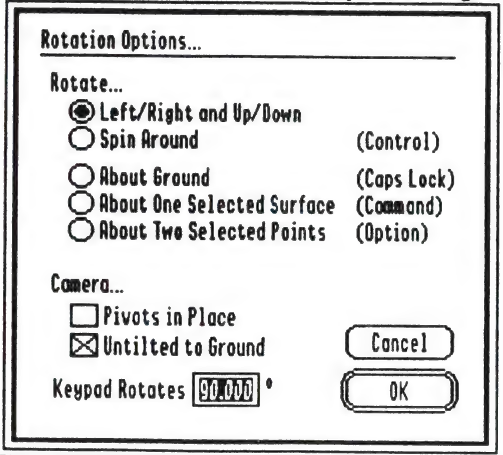
Rotate Tool

The Rotate tool has similar options as the Move tool, which will make the Rotate tool easy to understand.

First, make sure that the object is selected. Also make sure that your Caps Lock key isn't pressed down. Highlight the Rotate tool and click and drag to rotate the object. Notice that the object rotates in two directions: left / right and up / down. The directions are relative to your viewpoint instead of to the Ground. How do you rotate the object clockwise or counterclockwise? Hold down the Control key while clicking and dragging.

Rotating About the Ground

Objects can be constrained to rotate a certain way. One of those ways is to only rotate the object around the Ground's up-down direction. In other words, imagine a pole sticking straight up from the Ground and running through the object. Now imagine that an object can only rotate around the pole. That's the idea behind this next option. Command-click on the Rotate tool to display the Rotation Options dialog box.



Rotation Options...

Rotate...
- ● Left/Right and Up/Down
- ○ Spin Around (Control)
- ○ About Ground (Caps Lock)
- ○ About One Selected Surface (Command)
- ○ About Two Selected Points (Option)

Camera...
- ☐ Pivots in Place
- ☒ Untilted to Ground

Keypad Rotates 90.000 °

Click on the "About Ground" option and then click OK. Click and drag the mouse. The object may seem to rotate oddly at first, but when you realize that the object can only rotate one way, it will make sense. For instance, moving the mouse left and right will more closely correspond with rotating about an imaginary pole sticking straight up from the Ground. This option is useful for rotating the object in a certain direction without drifting in another.

Rotating About a Surface

An object can be constrained to rotate about an imaginary pole emanating from any of its surfaces. First select one of the object's surfaces. Next, Command-click on the Rotate tool to display the Rotation Options dialog box. Choose the "About One Selected Surface" option and click OK. Click and drag the mouse and notice how the object only rotates in one direction.

Rotating About Two Points

The last way an object can be constrained to rotate is about an imaginary line formed by two selected points. First unselect the surface. Now select two points if two points aren't already selected. Command-click on the Rotate tool to display the Rotation Options dialog box. Choose the "About Two Selected Points" option and click OK. Click and drag the mouse and notice how the object only rotates around the imaginary line formed by the two points.

Command-click on the Rotate tool and choose the "Left / Right and Up / Down" option. Click OK. The Rotate tool is back to its normal state.

Rotating with the Keypad

There are many times when it is necessary to rotate an object by a precise angle. For instance, you may want to rotate an object exactly one quarter turn. An easy way to do so is to press one of the keypad's keys that correspond to a particular direction. Press the "6" key on the keypad. It may be hard to tell with the simple cube object we're using, but it rotated one quarter turn to the right. Press the "4" keypad key and the object will rotate one quarter turn to the left. The function of the keypad's keys are as follows:

4 — Rotate Left
6 — Rotate Right
8 — Rotate Up
2 — Rotate Down
7 — Rotate Counterclockwise
9 — Rotate Clockwise

The amount of rotation is determined by the "Keypad Rotates" setting in the Rotation Options dialog box.

Rotation and the Center

When an object rotates, it rotates about its center. The center of an object can be thought of as a pivot point. The center can be repositioned so that the object pivots about a different point.

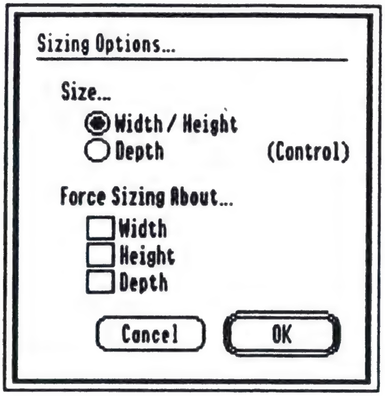
From the Object menu, choose Centers to make the objects' centers visible. Centers look like plus signs (+). Highlight the Select tool and unselect the object's two points. A quick way to do so is to click outside the object, which will unselect the object and its points. Reselect the object. Option-click on the object's center to select it. Now Option-click on the center and drag it outside of the object. (If the center will not move, make sure that the Move Options' "Points Radially About Center" option is unchecked.) Highlight the Rotate tool. Rotate the object and observe the way it rotates. The object swings around the center as if the object were a pendulum. You can, and should, use this to your advantage in situations where you want an object to swing around.

To put the center back in the middle of the object, choose Recenter from the Object menu. The Recenter function has some options that will make your life easier. If you wanted to position the center exactly on one of the object's points, simply select the point and choose Recenter. Or if you wanted to put the center in the middle of a surface, select the surface and choose Recenter. Basically, if an object has any selected points or surfaces, the averaged middle of the points and surfaces is where the center will be positioned. The only thing you must be aware of is that moving the center actually changes the position of the object. If you're animating the object, be sure of what you're doing when you reposition the center because the object will animate its moved position. The best advice is to plan ahead and only move the center of your objects *before* you begin to animate the objects. However, if after you've begun to animate the object that you realize the center must be moved, go to the first time in the animation where the object has a Position attribute, which is usually at 00:00.00, and then reposition the center. You may then have to step through your animation and check the position of your object.

Size Tool

Objects are resized with the Size tool. The Size tool is the easiest of the three tools to use. First make sure that the object is selected. Highlight the Size tool and then click and drag to stretch or shrink the object. Notice that the object stretches and shrinks in two directions: along its width and height. Hold down the Control key and click and drag. The object stretches in the third direction, which is along its depth.

How would you force the object to size equally in all directions at once? Command-click on the Size tool to display the Sizing Options dialog box.



Sizing Options...

Size...

● Width / Height

○ Depth (Control)

Force Sizing About...

☐ Width

☐ Height

☐ Depth

Under the "Force Sizing About" words, click on all three options: Width, Height, and Depth. Click OK. Click and drag the mouse to size the object. Notice how the object sizes equally in all directions.

To reset the Size tool's actions, Command-click on the Size tool to display the Sizing Options dialog box. Uncheck the three "Force Sizing About" options and then click OK.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

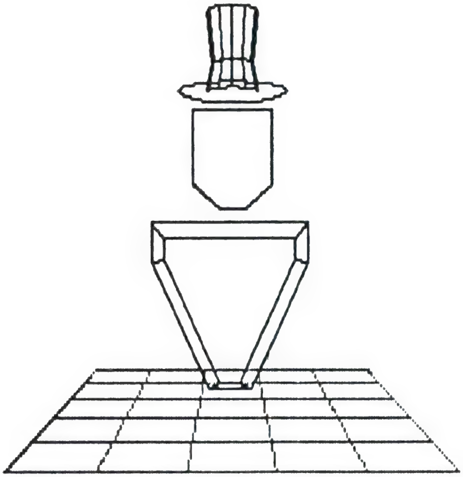
Tutorial Seven: Object Relationships

One of the features of Animasia 3-D that sets it apart from simpler 3-D applications is that Animasia 3-D allows objects to have parent-child relationships. An object is linked to another to create a relationship. Then, whenever the parent object is moved, rotated, or sized, the child object follows along with the parent.

There are two main uses for linked objects: The first and most common use is adding parts to a larger object, such as limbs to a robot. The robot's body is a parent to the head, and the head in turn is a parent to the hat. Any time the robot's body turns to the side, the head and hat will follow along. However, when the head turns, the hat follows but the body is unaffected.

The second use for linked objects is creating reusable animated actions. Instead of having to reanimate objects to do the same thing, you can animate just one object, and then link your object to the animated object. For example, to make your object bounce, you can link your object to an object that already bounces. Your object will inherit the bouncing attributes of the animated object.

This tutorial will focus upon linking objects. Open the project file "Tutorial.07." When the World window appears, you'll see a robot's body, head, and hat. These three objects are not yet linked to each other.



Link Tool

Objects are linked to each other with the Link tool. The Link tool is below the Rotate tool. We'll start by linking the head to the body. The body will be the parent and the head will be the child. You might think that the head should be the parent, but if you think carefully, you'll realize that the body is the base that controls the head.

Start by highlighting the Link tool. To link an object, first click on the object that is to be the child (the head), and then drag the mouse to the object that is to be the parent (the body). A green line will follow the cursor to indicate that a link is being created. Release the mouse button when the parent appears selected. The link between the objects is not something that can be seen; the link is invisible. If you made a mistake and linked the wrong two objects, or you linked the objects in the wrong order, choose Undo from the Edit menu and try again. Now link the hat to the head. Remember to click on the child first (the hat), and drag the cursor to the parent (the head). The hat is now a child of the head, and the head is a child of the body. This chain of objects is also referred to as a *hierarchy.*

The three objects are linked and the head and the hat should now appear selected. (Linking also selects the two linked objects.) For now, unselect the head and hat, and then select the body. Remember to first highlight the Select tool so that we don't accidentally link more objects. The head and hat are not required to be unselected, but it will better emphasize the following steps.

Moving Parents and Children

Highlight the Move tool and move the body. What happened? Not only did the body move, but ***the head stayed with the body and the hat stayed with the head!*** Now select the head and move it. What happened? The head and hat moved but the body didn't. What this all means is that the child *inherits* its position from its parent, but the reverse isn't true; the parent receives nothing from the child. Choose Undo from the Edit menu to return the head to its original position over the body. We want the robot to keep its head for now.

Rotating Parents and Children

Rotating a parent works like moving a parent. First choose Centers from the Object menu. It's preferable to see an object's center while rotating so we know exactly the point about which the object is pivoting. Select the body and then use the Rotate tool to rotate the entire hierarchy of objects. Not only will the body rotate, but the head and hat will stay with the body's new orientation. Select the head and rotate it. The hat follows the orientation of the head. The children are inheriting the orientation *and* position of their parent. It's obvious that the orientation is being inherited, but the position is inherited as well. If the position wasn't inherited, the object would stay in one place and not follow the parent when the parent rotates. Choose Undo from the Edit menu to return the head and body back to their original orientations.

Sizing Parents and Children

Select the body object. With the Size tool, stretch the body and observe what happens. Not only does the body resize, but the head and hat also resize with the body. Select the head and resize it. The hat stretches and repositions itself with the head. The children are inheriting the size *and* position of their parent. It's obvious that the size is being inherited, but the position is inherited as well. If the position wasn't inherited, the object would stay in one place and not follow the parent when the parent changes size. Choose Undo from the Edit menu to return the head and body back to their original sizes.

Inheritance

We saw how the child objects inherited the position, orientation, and size of their parents. Is it possible to tell a child not to inherit its parent's attributes, and is it desirable? Yes and yes.

Inheriting Orientation From the Parent's Orientation

Follow along with this example. Select the head object so that only the head is selected. From the Appearance menu, choose Inherit Orientation from Orientation to uncheck this option. We have just told the child not to inherit its orientation from its parent's orientation. Select the body and rotate it. Notice that the head follows the position of the body, but the head's orientation stays the same. Undo the body's rotation and also undo the change of inheritance.

Inheriting Position From the Parent's Orientation

We'll try changing a different inheritance option. Select the head object so that only the head is selected. From the Appearance menu, choose Inherit Position from Orientation to uncheck this option. We have just told the child not to inherit its position from its parent's orientation. Select the body and rotate it. Notice that the head's position does not follow the body, but the head's orientation still follows the body's orientation. Undo the body's rotation and also undo the change of inheritance.

Inheriting Position From the Parent's Size

Select the head object so that only the head is selected. From the Appearance menu, choose Inherit Position from Size to uncheck this option. We have just told the child not to inherit its position from its parent's size. Select the body and resize it. Notice that the head's position does not follow the body, but the head's size still follows the body's size. Undo the body's size and also undo the change of inheritance.

Inheriting Size From the Parent's Size

Select the head object so that only the head is selected. From the Appearance menu, choose Inherit Size from Size to uncheck this option. We have just told the child not to inherit its size from its parent's size. Select the body and resize it. Notice that the head's size does not follow the body's size, but the head's size stays the same. Undo the body's size and also undo the change of inheritance.

A child will always inherit its position from its parent's position. In other words, the child will always move when the parent moves.

Changing the way a child inherits its parent's attributes is not as suited to parts of a robot as it would be to other situations. For example, if you linked a moon to a planet, you wouldn't want the moon to rotate or move in addition to the planet's rotation. In this case, you would turn off Inherit Orientation from Orientation and Inherit

Position from Orientation. The moon would still move when the planet moved, but the moon would be unaffected by the planet's rotation.

Consider another situation. Someone once created an animation of what seemed to be one hundred hammers all striking one hundred anvils in unison. What would be the easiest way to recreate this type of animation with Animasia 3-D? Hint: it involves linking and inheritance. The best way would be to create the one hundred hammers and link all the hammers to just one master hammer. The master hammer would be the only hammer that would need to be animated. Inherit Position from Orientation would then be disabled for all of the "slave" hammers. In other words, you don't want the slave hammers to rotate *around* the master hammer; you want the slave hammers to rotate *in place* when the master hammer rotates to strike the anvil. Thus the slave hammers would follow the master hammer's striking motion. (As a tip, it is best to set the inheritance of the children *before* you link the children to the parent because it's faster than setting the inheritance after the link is made.)

Inheriting Size

When a child inherits the size from its parent, there is one thing to be aware of that would otherwise be confusing. Sizing the parent in a particular direction may not make the child resize in the same expected direction. For example, making the parent taller may not make the child taller but instead wider. Why? The child sizes along the same *inherent* direction as the parent. If the inherent directions of both objects are not in line, the child will appear to resize about a different direction, like become wider instead of taller. The three inherent directions of an object are determined at the time the object is created.

The best way to prevent mis-sizing between objects is to beforehand see the objects' inherent relationships. To do so, select both objects and choose Reset Orientation from the Align menu. Do the objects line up properly? If not, then one of the objects needs to be reoriented and have its inherent directions changed. To do so, reorient an object and choose Fix from the Object menu. Currently, some of the tools, like Lathe, Ring, and Spiral, will change the inherent directions of objects without it becoming apparent. If you use these tools to make objects, you may want to Fix the object before linking it to other objects.

Copying Hierarchies of Objects

When you want to copy a parent and all of its children so that you can create a duplicate of the entire hierarchy of objects, you must select all of the objects in the hierarchy. Selecting just the first parent object will only copy the parent.

Let's try an example. Select the body object. From the Edit menu, choose Select All Children. Now choose Copy from the Edit menu. Choose Paste. The pasted objects will appear in the same place as the original. With the Move tool, move the duplicate body, head, and hat to another part of the World window.

However, if you only wanted to copy the head and the hat, you would select just the head and the hat.

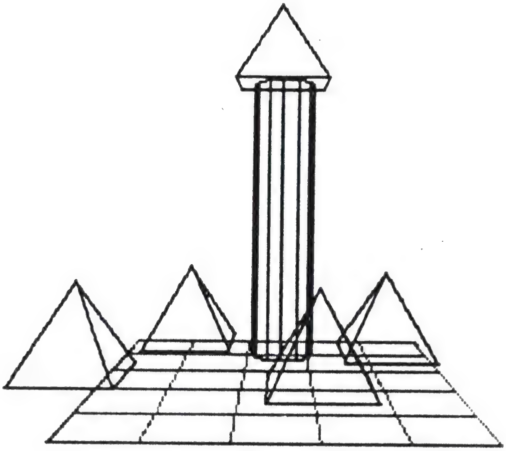
Unlinking Children

A child can be unlinked from its parent. Select the head object so that only the head is selected. Click on the Unlink tool, which is to the left of the Link tool. The Unlink tool performs an immediate action: it unlinks all selected children from their parents. Now move the body. The head doesn't respond because the head is no longer linked to the body.

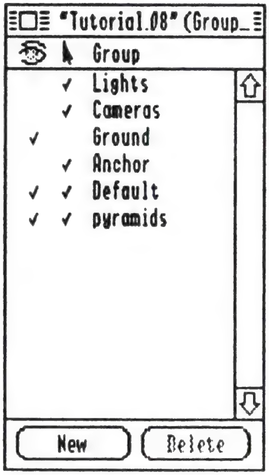
You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Eight: Object Grouping

Every project has three windows. So far, we've only dealt with the World and Timeline windows. The third window of a project is the Groups window. Knowing how to use the Groups window is not necessary to create simple worlds and animations, but once many objects occupy a world, editing will be much easier if Animasia 3-D's grouping capabilities are taken advantage of.



Open the project file "Tutorial.08." When the World window appears, go to the Window menu and choose "Tutorial.08" (Groups). The Groups window will appear. The focus of this tutorial will be to introduce you to the function of the Groups window.



"Tutorial.08" (Group_

		Group
	✓	Lights
	✓	Cameras
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	✓	Anchor
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Groups

A *group* is simply a category to which objects belong. Every object must belong to a group. The Groups window displays a list of all of a project's groups. A project can have an unlimited amount of groups. Groups, as will be explained, are used with the World window; groups have no relation to the Timeline window.

The primary purpose of groups is to make editing tasks in the World window easier. Along these lines, groups do two things:

- Hide objects.
- Make objects unselectable.

Hiding Objects

Find the group named "pyramids." You'll see two check marks before its name. Click on the first check mark; it is the check mark that is under the picture of an eye. The check mark disappears but what else happened? In the World window, all of the pyramid objects disappeared. Where did they go? The pyramid objects didn't "go" anywhere. They are temporarily hidden from view. Click again in the same space. The check mark reappears and so do the pyramids. In other words, the first check mark determines if the objects in a particular group will be hidden or not. Being able to hide objects from view is an invaluable aid when a world has many objects. Not only will the world be less cluttered, but with fewer objects to recalculate, changing the viewpoint will be faster. (Changing the viewpoint will be covered in future tutorial.)

Standard Groups

All of the following groups are standard with every project.

Find the "Default" group. This is the group that all new objects belong to. Whenever you create a new object, like an oval, the object is put into the Default group. Click on the Default group's visible check mark. Did anything hide? The column. Leave the column hidden for now.

Find the "Anchor" group. This group is used to hide the Anchor object. Click in the vacant space to unhide the Anchor group. You will see the Anchor object become visible. The Anchor object looks like a blue cross and is used for positioning objects. The Anchor will be covered in a future tutorial.

Find the "Ground" group. This group is used to hide the Ground object. Click on the check mark to hide the Ground. Click again to make the Ground visible. The Ground has a special use and it also will be covered in a future tutorial.

Find the "Cameras" group. This group is used to hide the cameras of a world. Click in the vacant space to unhide the Cameras group. You won't see any of the cameras because they're out of our view. Cameras will be covered in a future tutorial.

Find the "Lights" group. This group is used to hide the lights of a world. Click in the vacant space to unhide the Lights group. You will see the two default light objects become visible. One light will appear at the top of the window and the other will appear under the Ground. Lights will be covered in a future tutorial.

Preventing Selection of Objects

Have you noticed that you never could select the Ground object? The reason is because the group to which the Ground object belongs, the "Ground" group, has its second check mark turned off. The second check mark appears under the picture of the Select tool. If a check mark is under the picture of the Select tool, then the objects in that particular group can be selected. If there is no check mark, then the objects cannot be selected. The Ground object is made unselectable by default because it would be frustrating to be continually selecting the Ground by accident. Click in the vacant space to make the second check mark appear. Click on the World window to make it frontmost. Now try selecting the Ground. You can move, rotate, and size it.

Making objects unselectable is useful for when an object or set of objects should be visible but not get in the way of editing.

The Default Group

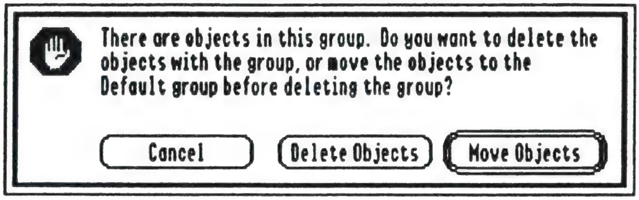
Highlight the Rectangle tool and create a rectangle object anywhere in the World window. Wait a minute. The rectangle object disappeared as soon the mouse button was released. What's going on? Remember that all new objects are put into the Default group. Also remember that we left the Default group hidden. So all new objects will be immediately hidden. Let's go back to the Groups window. A shortcut is to click on the icon in the World window that looks like an eye. Find the "Default" group and click in the vacant space to make the first check mark appear. The World window will unhide the objects in the "Default" group.

New Groups

Making groups for new objects as you go along is a good practice because it helps organize your work. Make the Groups window frontmost. At the bottom of the window, click on the New button. A new group will appear at the bottom of the list. Double-click on the group's name. (Remember to click twice in rapid succession.) A dialog box will appear asking you to change the name of the group. Type "columns" and click OK. Notice that the new group, whose name is now "columns," is highlighted in the list. The highlighted group is the *current* group. Click on the World window to make it frontmost. Select the column object so that only the column is selected. From the Object menu, choose Put in Current Group. The column now belongs to the "columns" group instead of the "Default" group. Let's copy the column to illustrate a point in the next section. Choose Copy from the Edit menu.

Deleting a Group

Suppose we wanted to remove a group. Make the Groups window frontmost. Highlight the "columns" group. Click on the Delete button. A dialog box will appear and indicate that the group to be deleted contains objects.



There are objects in this group. Do you want to delete the objects with the group, or move the objects to the Default group before deleting the group?

The two main choices are to delete the objects with the group or to move the objects to the "Default" group first. Click on the Delete Objects button. The "columns" group and the world's column object, which belonged to the group, are now deleted.

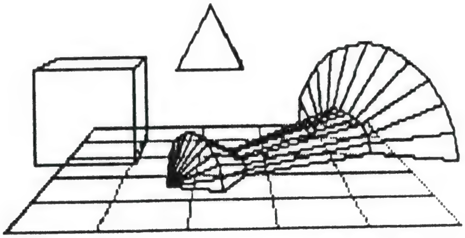
Remember that we have a copy of the column in the Clipboard. Make the World window frontmost. From the Edit menu, choose Paste. A copy of the column is pasted back into the world. Now make the Groups window frontmost. What do you see? At the bottom of the list, the "columns" group is present. How can this be? We just deleted the "columns" group a moment ago. What happened was this: when the column object was copied into the Clipboard, the Clipboard remembered the object's group, which was "columns." When the column object was pasted back into the world and no "columns" group could be found, a new "columns" group was created automatically for the column object. This way, copied objects will always retain their group regardless of the world they're pasted into.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Nine: Cameras

When you view objects in the World window, you are actually looking through a camera. The initial camera that you look through is called the "Main" camera. By looking through different cameras, you see different views of the world. Seeing different views of the world is especially important when aligning objects.

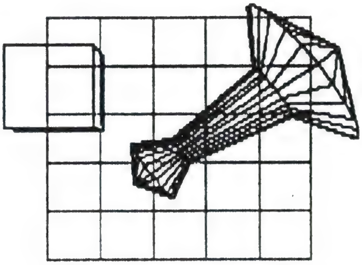
Open the project file "Tutorial.09." When the world window appears, you'll see several objects. The focus of this tutorial will be to look at the objects from different viewpoints.



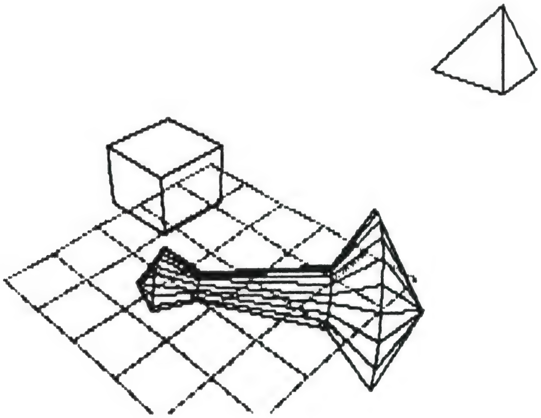
Notice the title of the World window. It says "Tutorial.09" (World - Main). Where it says Main, that indicates we're looking through the camera named "Main." Click on the Camera menu but don't choose anything yet. Notice the check mark next to the name Main. That also indicates we're looking through the camera named Main. In this case, Main is the *current camera*. The current camera is the camera that is being looked through.

Changing the Viewpoint

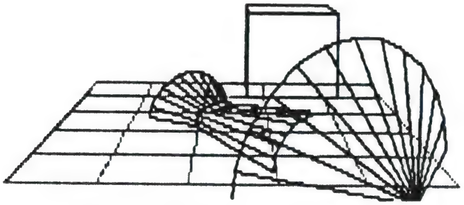
From the Camera menu, choose Top. After a brief pause, the World window will redraw itself. We're now looking down on the Ground and the objects. In other words, we're looking from above, or *on top of*, the objects. This is the Top camera. Notice that we can't see all of the objects. The red pyramid that we saw from the view of the Main camera is not in view of the Top camera. That's okay because the pyramid might be in view of the other standard cameras.



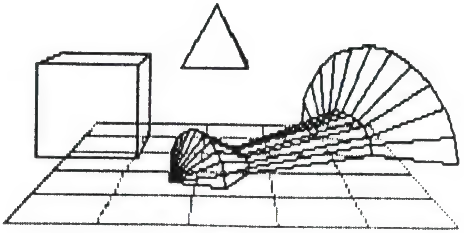
From the Camera menu, choose Diagonal. After a pause, the World window will redraw itself. We're now looking down on the Ground and the objects, but in a diagonal direction. This is the Diagonal camera. Notice that we can see the red pyramid because it's in the view of the Diagonal camera.



From the Camera menu, choose Right. After a pause, the World window will redraw itself. We're now looking from the right side of the Ground and the objects. This is the Right camera. Notice that we can't see the red pyramid because it's not in the view of the Right camera.



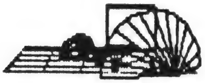
The only camera that we haven't looked through is the Front camera. From the Camera menu, choose Front. If the view looks familiar, it's because the Front camera has the same view as the Main camera. Even though they have the same initial view, they're not the same. The Main and the Front cameras have different purposes.



We now know what the views look like from each of the five standard cameras. As was just mentioned, there is a functional difference between the Main camera and the others. The Main camera is the only camera of the five that can be animated. The other four, the Front, Right, Top, and Diagonal cameras, cannot be animated. These four cameras are called *editing cameras* because their primary use is visualizing the way objects align with each other. (Aligning objects with the help of the editing cameras will be covered in a later tutorial.)

Moving In and Out

From the Camera menu, choose Right. Looking through the Right camera, notice that the yellow object is uncomfortably close to our viewpoint. How do we move the camera back? From the Camera menu, choose Move Out. After a pause, the view will still be from the Right camera but pulled back. Also notice that we can now see the red pyramid because we're far enough back for it to be in view.



From the Camera menu, choose Front to make the Front camera the current camera. Notice that the Front camera has also been pulled back. Why? When choosing Move Out or Move In, the moving process will affect all of the editing cameras if one of the editing cameras is the current camera. If we had told the Main camera to Move Out, then the other cameras would not move because the Main camera is not an editing camera. (The Reference section contains additional Move In and Move Out options.)

Aligning the Editing Cameras

As mentioned before, the editing cameras have a special use and that is to help visualize the placement of objects. We'll try an example. Select the pyramid object. From the Align menu, choose Align Editing Cameras. After a pause, the Front, Right, Top, and Diagonal cameras will align themselves so as to be as close to the pyramid as possible. Because the current camera is the Front camera, the view will change to a close up of the pyramid. Make the Top camera the current camera; it too is aligned with the pyramid. If we wanted to do detail work on the pyramid, it would certainly be possible now.

What if we wanted the editing cameras to view all of the objects? First select all of the objects. An easy way to do this is to go to the Edit menu and choose Select All. Now, choose Align Editing Cameras from the Align menu. Because the current camera is an editing camera, it changes its view to encompass all of the selected objects. Make the Right camera the current camera. Notice that it too can see all of the objects including the pyramid.

Because the editing cameras can't be animated, you don't have to worry that changing the position of an editing camera at a new time will animate the camera's movement.

Moving the Camera Interactively

The current camera can be moved interactively, which makes positioning the camera an easy task. From the Camera menu, choose Main to make the Main camera the current camera. Select at least one object, like the yellow object. In the Tool window, highlight the Move tool *and* the Camera tool. The Camera tool is to the right of the Oval tool. Make sure that both tools are highlighted. Now click in the World window and drag the mouse. What happened? The yellow object appeared to move, *but it was the camera that was actually moving*! The Camera tool modified the use of the Move tool so that only the camera moved. How would you interactively move the camera in and out? Remember that the shortcut for moving in the third direction is to hold down the Control key while moving. Try it now. Hold down the Control key and click and drag. The camera moves in and out.

You should've noticed by now that the Ground object also highlights itself when moving the camera. The Ground does this for reference purposes. In fact, the only reason why an object needs to be selected is for feedback. The selected object is never moved when the Camera tool is highlighted—only the camera is moved.

Orienting the Camera Interactively

The current camera can also be made to interactively view the world from a different location and orientation. With the yellow object still selected, highlight the Rotate tool and keep the Camera tool highlighted as well. In the World window, click and slowly drag the mouse. What happened? The camera's viewpoint swung around the selected object while still pointing at the object. It's obvious that the camera's position changed, but the orientation changed so that the camera would point at the same objects.

How would you make the camera simply pivot in place instead of swing around objects? Command-click on the Rotate tool. At the bottom of the Rotate Options dialog box, click on the Pivots in Place option to enable it. Click OK. With the yellow object still selected, try rotating the camera. The camera now pivots in place, which means that its position doesn't change but its orientation does.

You may or may not have noticed that the camera remained upright with respect to the Ground. Normally, you'll want to stay upright, but if you don't, you need to set an option. Command-click on the Rotate tool. Uncheck the Untilted to Ground option and uncheck the Pivots in Place option. Click OK. Now click and drag the Rotate tool. The camera spins around the selected object with less delay than before but it doesn't remain upright. How would we make the camera untilt itself? From the Camera menu, choose Untilt to Ground. Command-click on the Rotate tool and recheck the Untilted to Ground option. This option is best left on. Click OK.

Notice that the Camera tool is still highlighted. Sometimes it's easy to forget that it's highlighted, and when we want to move or rotate some objects, the camera is affected instead of the objects. If this happens, choose Undo and then unhighlight the Camera tool.

New Cameras

We can create an unlimited amount of new cameras. A new camera is useful for establishing a viewpoint that you want to come back to many times. For example, you may want a viewpoint that looks at the backsides of the objects. To do this, first choose Add Camera from the Camera menu. Although nothing will appear to happen, check the World window's title. The last half should say World - camera 1. Camera 1 is the name of our new camera and has the same position and orientation of the previous camera. Now position and orient this new camera to view the objects from another viewpoint.

Making an Object the Current Camera

From the Camera menu, choose Main. The Main camera is now the current camera. How do we make camera 1 the current camera again? Make sure that all objects are unselected. From the Camera menu, choose Make Object Current. A dialog box will appear with a list of all the objects' names. Highlight camera 1 and click OK. Camera 1 is made the current camera.

Camera Group

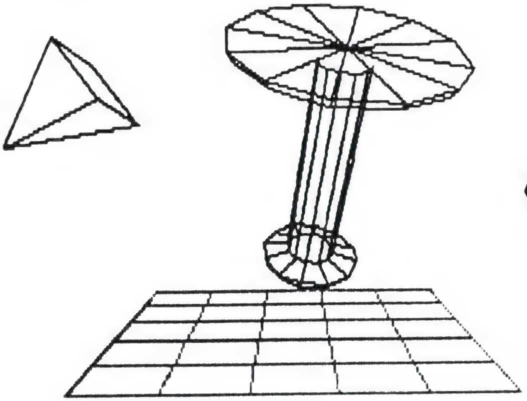
Cameras are objects just like every other object in the world. All cameras belong to the "Cameras" group, and the group is initially marked as hidden. The cameras are hidden so as not to clutter the world.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Ten: Alignment

Sooner or later, there will come a time when you want to make "Object A" align perfectly with "Object B." Aligning a bookshelf to a wall or a wing to a bird is not difficult once you know the basic principles.

Open the project file "Tutorial.10." When the World window appears, you'll notice several objects. The focus of this tutorial will be to stack the objects.



The Ground

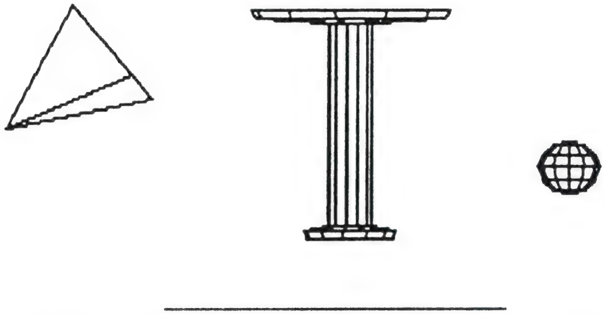
If you thought the Ground object was for ornamentation, you'll be surprised to learn of its true purpose. Not only does the Ground visually help orient yourself in 3-D space, the Ground is used to orient and align objects. When we need to orient an object in a precise way, we first orient the Ground and then orient the object to match the Ground. We then put the object on the Ground and slide the object to its desired location. This technique, while different, is effective. If you don't understand, that's okay because we'll be doing an example.

Perspective

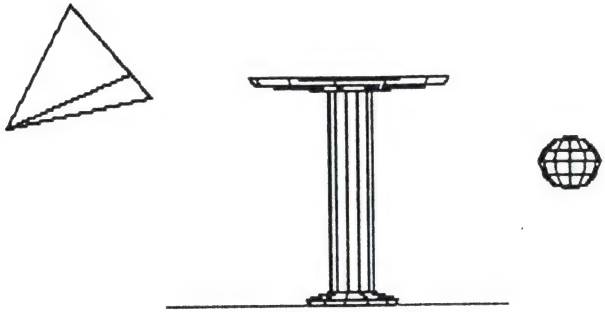
Before beginning, notice how the effect of *perspective* skews the objects. Perspective is a visual cue that helps us determine the distance of objects from our viewpoint. Perspective distorts the appearance of objects. For example, the Ground appears wide at its closest point to us, but narrows as it recedes into the distance. Perspective gives our images a sense of reality, but that same reality is not beneficial for some tasks, like aligning objects. If an object appears distorted, how can we accurately align it with another object? The answer is to temporarily turn off the effect of perspectiveness. From the Camera menu, choose Perspective to uncheck this option. Changing the perspectiveness of one camera changes the same trait in all cameras. The objects now appear flat and unnatural, which is how they should appear without perspective. We are ready to align objects.

Aligning

How do we orient the white pedestal so that it is upright? Follow this example. First select the pedestal. From the Align menu, choose Orient to Ground. The pedestal snaps to the Ground's orientation, which is upright. More specifically, the Orient to Ground function determines which surface of the pedestal's bounding box faces closest to the Ground. In our case, this was the bottom surface of the bounding box. The rest of the object was tilted so that this surface would be level with the Ground.

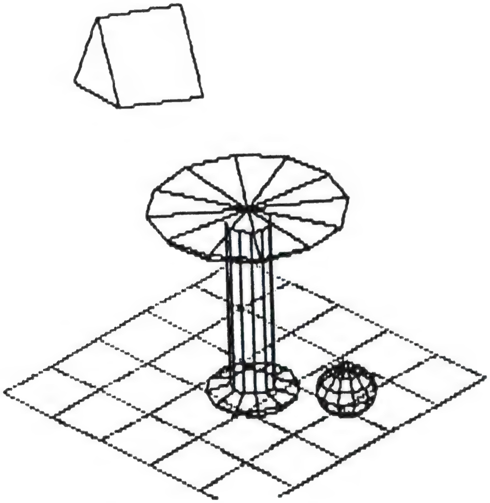


Now that the pedestal is upright, how do we put it on the Ground? With the pedestal still selected, choose Position to Ground from the Align menu. The pedestal drops to land on the Ground. Just like the previous function, Position to Ground determines which surface of the pedestal's bounding box faces closest to the Ground. In our case, this was the bottom surface of the bounding box. The rest of the object was positioned so that this surface would land on the Ground.



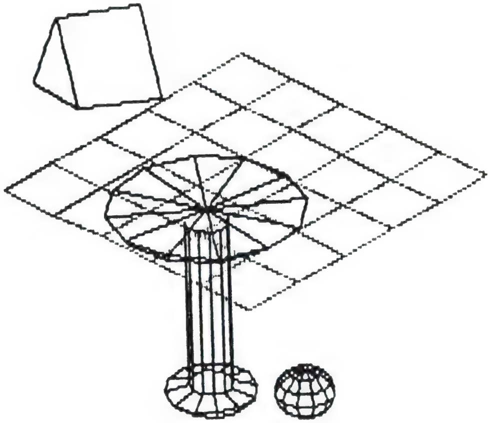
When putting objects onto the Ground as we did with the pedestal, it's important to note that objects should first be oriented and *then* be positioned—not the other way around. Orientation followed by positioning produces the most accurate results.

Now that the pedestal is properly set in place, how do we put the pyramid on top of the pedestal? First we need to change our viewpoint so we can look at the top of the pedestal. From the Camera menu, choose Diagonal so that we're looking through the Diagonal camera.

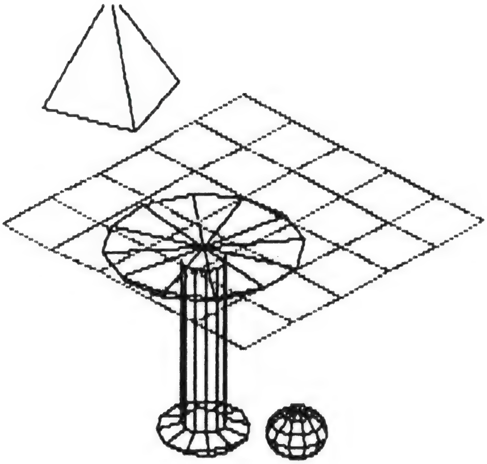


We want to orient the pyramid so that its bottom is level with the top of the pedestal. With the pedestal still selected, select any one of its top, triangular surfaces. (Command-click with the Select tool to select surfaces.) We already know that the Ground is level with the top of the pedestal, but it doesn't hurt to be absolutely sure. From the Align menu, choose Orient Ground to Surface. The Ground doesn't appear to do anything because it's already level with our selected surface. However, if the Ground wasn't level with the surface, it now would be.

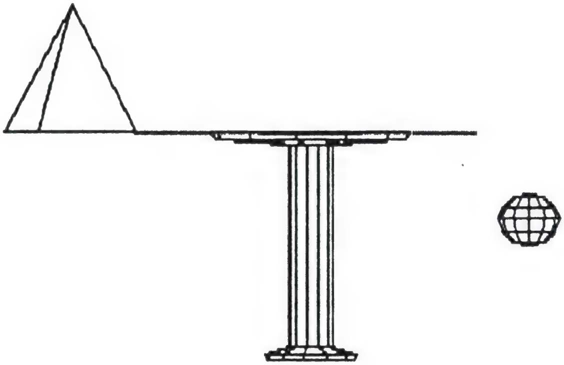
Next, choose Position Ground from the Align menu. The Ground is moved so that it is on the selected surface.



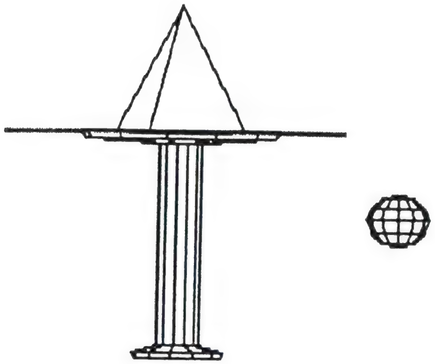
Select the pyramid so that only the pyramid is selected. We want to orient the pyramid so that its bottom is level with the Ground. Select the bottom surface of the pyramid. From the Align menu, choose Orient to Ground. The pyramid snaps straight upwards.



To position the pyramid, it would be best to switch the viewpoint back to the Front camera. From the Camera menu, choose Front. We can see that the pyramid is still above the pedestal and Ground. From the Align menu, choose Position to Ground. The pyramid drops down to the plane of the Ground. Remember that the bottom of the pyramid is still selected. If part of an object is selected, the Align menu's orientating and positioning functions will use whatever is selected to override the functions' default methods. In this case, the selected surface was positioned onto the Ground. (The Reference section for the Align menu describes each function's options.) Note that the pyramid isn't directly on top of the Ground but is almost hovering in space off to the side. This is not a problem. When an object is positioned to the Ground, the object is dropped down onto an imaginary plane that stretches infinitely beyond the Ground's boundaries. In essence, the pyramid *is* on the Ground.



The pyramid still isn't directly over the pedestal where we want it. Moving it there is easy. Command-click on the Move tool so that the Move Options dialog box is displayed. We want to constrain the movement of the pyramid so that it stays parallel to the Ground at all times. Click on the On Ground option and then click OK. With the pyramid object still selected, move the pyramid so that it is directly over the top of the pedestal.

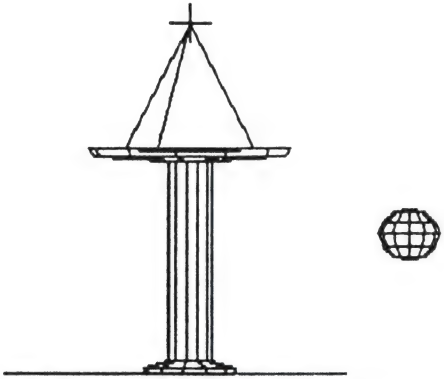


When positioning objects, we have to look at the objects from at least two different viewpoints or the objects may not actually line up properly. From the Camera menu, choose Right to make the Right camera the current camera. As you can now see, the pyramid was only centered on the pedestal from the Front view and not the Right. Move the object so that it is centered over the pedestal. It sometimes helps to hold down the Shift key when moving so as to further constrain the movement to one direction. Command-click on the Move tool and turn off the On Ground option by clicking on Left / Right and Up / Down. Click OK. Make the Front camera the current camera. The pyramid is now directly on top of the pedestal. To reset the Ground's position, choose Home Ground from the Align menu.

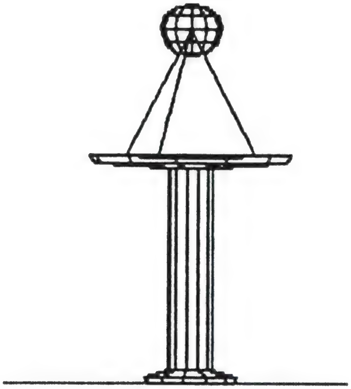
The Anchor

Besides the Ground, there is one other special object that is used to help position objects. It is called the Anchor. The Anchor is used for positioning objects at a precise point. The Anchor is not initially visible because it is in a hidden group. To make the Anchor visible, first open the Groups window by clicking on the World window's eye icon. Find the group named "Anchor" and click in the vacant spot under the eye icon. Make the World window frontmost. Look in the middle of the pedestal's column. You'll see a blue line, which is actually part of the Anchor. Use the Select tool to select the Anchor and, for now, move the Anchor off to the side to better see it. You'll notice that the Anchor appears as a blue cross.

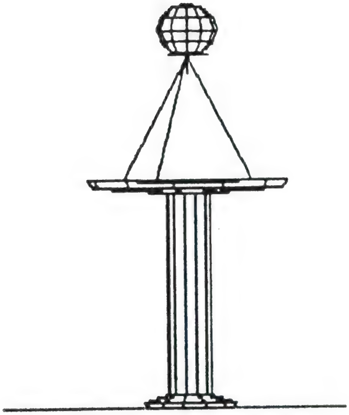
How would we place the ball on the top of the pyramid? We could use the Ground again, but the Anchor would be faster. Follow these steps. Select the pyramid. Select the top point of the pyramid by Option-clicking on the point. From the Align menu, choose Position Anchor. The Anchor moves to the pyramid's selected point.



Now select the yellow ball so that only the ball is selected. Choose Position to Anchor. The ball moves to the Anchor in such a way that the ball's center is at the Anchor.



Suppose we wanted to have the bottom of the ball touching the top of the pyramid. Choose Undo from the Edit menu. We want to select the bottom-most point of the ball. To make the task easier, use the Rotate tool to turn up the ball so that we can see its bottom point. Use the Select tool and select the point. (Remember, Option-clicking selects points.) With the point selected, choose Undo. We are undoing the rotation of the ball, not the selection. The ball is now back to its original orientation but with the bottom point still selected. From the Align menu, choose Position to Anchor. The bottom point of the ball is now resting on the tip of the pyramid.



We can turn the perspective back on again. From the Camera menu, choose Perspective. The objects won't appear flat anymore. You might want to look at the scene through the Diagonal camera to get a more interesting view.

Be aware that aligning objects to the Ground and Anchor will animate the position or orientation of the objects if the current time has changed. Notice that in the Align menu there are some menu items which are *italicized* and some that are not. The italicized menu items indicate that a menu item's function will cause the selected objects to be animated if the current time has changed. Because the Ground and Anchor are special editing objects and cannot be animated, the menu items which relate to them are not italicized.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, try the following exercise, or you can continue to the next tutorial. Regardless, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Exercise — Stack Three Blocks

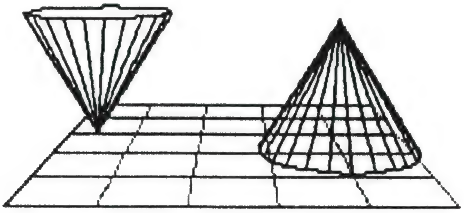
Now that you know how to use the Ground and Anchor, you can try to stack three blocks on top of each other. Hint: You'll only need to use five functions from the Align menu, but not in this order: Orient Ground to Surface, Orient to Ground, Position Ground, Position to Ground, and Home Ground.

To make the blocks visible, you will need to go to the Groups window and find the "blocks" group. Click in the vacant space under the eye icon to make the objects in the "blocks" group visible.

Tutorial Eleven: Lights

Lights are added to worlds to brighten the appearance of objects. Lights can be colored and they can be animated just like any other object. When you begin to create your own worlds, the lights will most likely be the last elements to be added because testing the effects of lights can be time consuming. Realize that it isn't necessary for lights to be added to a world if you do not want shaded objects. For instance, a cartoon-type animation will have no shading.

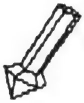
Open the project file "Tutorial.11." When the World window appears, you'll notice a few cone-shaped objects. The focus of this tutorial will be to light the objects in different ways.

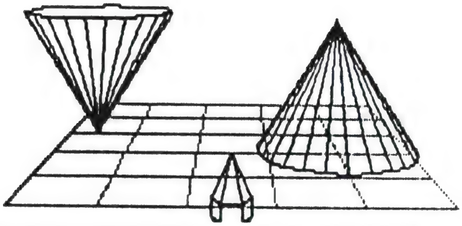


Light Group

All lights have their own group and it's appropriately called the "Lights" group. The "Lights" group hides the lights so as to keep the world uncluttered. Although it's not necessary for the lights to be visible for their effects to be seen, we want to view the lights for illustration purposes.

Make the Groups window frontmost by choosing "Tutorial.11" (Groups) from the Windows menu. Find the group named "Lights." In the vacant space under the eye icon, click to make a check mark appear. After a moment, two objects will appear in the World window. Make the World window frontmost. The two objects are the two standard lights of the world. Specifically, the object at the top of the window is a *directional* light and the object at the bottom of the window is an *ambient* light. The ambient light is tucked under the Ground and is a little hard to see at this moment. Later, we will get a better look at it.



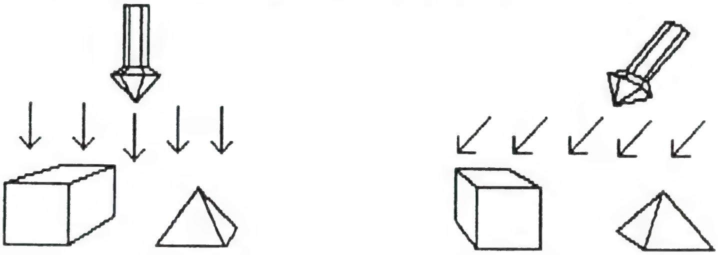


Standard Lights

As was mentioned, the two standard lights of a world are the ambient and directional lights. The ambient light provides a base lighting for the world. All objects, regardless of where they are or the direction they face, are evenly lit by the ambient light. This light is used to ensure that no part of an object will be in total darkness. However, if you wanted to create harsh lighting, it would be a good idea to make the ambient light black. For now, leave the ambient light the way it is.

Directional Lights

The directional light is a different kind of light from the ambient light. Directional lights illuminate the world in a manner similar to the sun. Because the sun is very far away, its rays of light strike the earth from one direction and do not spread out. Thus all earthly things, regardless of location, receive light from essentially one direction. Directional lights work the same way. They shine light on all objects in the direction that the light aims. To help you match the function of a directional light to its appearance, a directional light looks like a pointed arrow. The directional light is also the only object of all of the world's standard objects that can be deleted. (But don't delete it now.) If you didn't want the directional light in your world, you could delete it.



(The rays of a directional light strike objects from the same direction.)

Lighting

To see the effects of lighting, there are two settings that must be enabled in the Image menu. First, make sure that there's a check mark next to the Shading option. Without shading, objects will appear as solid colors. Second, choose Display as Solids. Be patient while the image is redrawing; it may take anywhere from 12 to 34 seconds depending upon the speed of your system. When the image is redrawn, all the objects except the lights appear shaded. (You won't be able to see the ambient light because it's underneath the Ground.)

Notice how the objects are illuminated from the directional light. More specifically, the highlights on the objects are produced by the directional light, and the backsides of the objects are filled by the ambient light. What you won't see are shadows. Currently, Animasia 3-D only shades objects but does not draw shadows.

Light Color

The color of a light determines the color that it emits. Suppose we wanted to make the directional light shine a yellow color, like the sun. Select the directional light and then click on the yellow color in the palette. Be patient while the image is being recomputed. When the image is redrawn, the objects appear to be shaded yellow. The objects aren't really yellow, but the light is. Try making the light another color of your choice. (If you make a light black, it won't shine any color.) Shaded, color images lose their subtlety because of the limited color palette. However, choosing the Shades of Gray option from the Image menu renders the image in gradual tones ranging from black to white. Try it now. Notice how much of a difference this option makes. Turn off the Shades of Gray option to restore color shading.

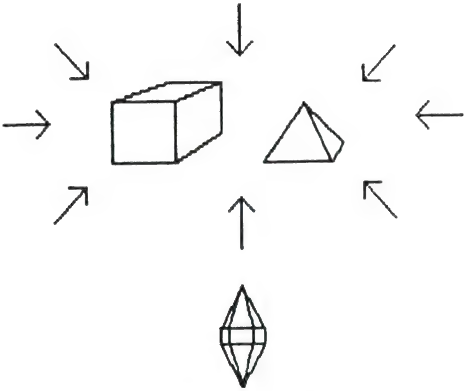
Rotation and Position

Rotating the directional light changes the direction of its light. With the directional light selected, rotate it to a different orientation. When the image redraws, the objects will appear lighted from the new direction.

Because only the orientation, or direction, of directional lights is important, changing the position does not change the lighting of the world. Try moving the directional light to a new position. The objects' shading stays the same.

Ambient Light

As mentioned before, the ambient light provides a base light for all objects of the world. Although it can't be seen at the moment, the shape of the ambient light is a double-cone. The default color of the ambient light is a low, gray color. This neutral color is suitable for many situations, but you may find that a different intensity of gray, or a different color entirely, is better suited to your world.



(The ambient light provides a base lighting over all objects.)

To change the color of the ambient light, first select it. Because it's underneath the Ground and would be hard to find, we can select it by name. From the Edit menu, choose Select By Name. From the dialog box, highlight the Ambient name and click OK. You should see a selection box under the Ground; the ambient light is selected. To change the color of the ambient light, click on any color in the palette, but make it a different color from the directional light. For example, if you choose a pink color, the "dark" sides of the objects will appear pink. More specifically, the color of the ambient light is *added* to the color of the other lights. If your directional light is blue and your ambient light is pink, the blue areas of the shaded objects will have pink mixed in to produce a slight purplish shade.

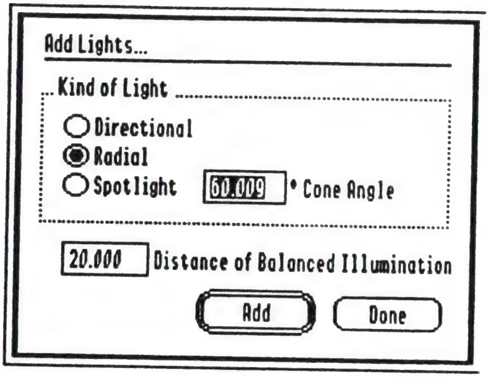
Rotation and Position

The ambient light's position and orientation do not affect the lighting of the world. For example, with the ambient light still selected, move it off to the side. The objects' shading does not change. Likewise, rotate the ambient light. The shading still doesn't change.

Adding Lights

An unlimited number of lights can be added to a world. In practice, it's best to use as few lights as possible to achieve the desired lighting effect because every new light slightly increases the time it takes to recompute a shaded image.

From the Object menu, choose Add Lights. A dialog box will appear with three choices. These choices represent the types of lights you can add.



Add Lights...

Kind of Light

○ Directional
● Radial
○ Spotlight 60.000 ° Cone Angle

20.000 Distance of Balanced Illumination

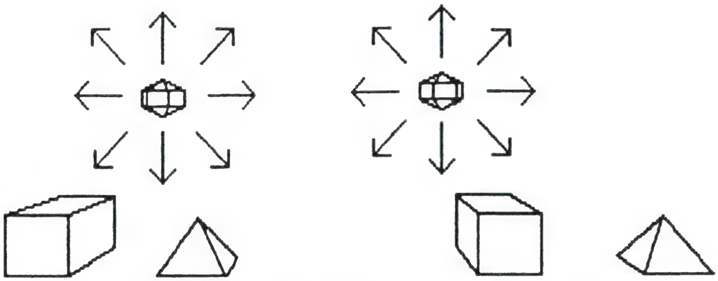
- **Directional** — This is the same type of light that we've used.
- **Radial** — This light mimics an unshielded light bulb. Light spreads out in all directions from one location, decreasing intensity with distance.
- **Spotlight** — This light mimics a desk lamp. Light shines in one direction, but limits its influence to a cone of light. Intensity decreases with distance.

You've probably noticed that there's no choice for ambient lights. That's because one ambient light per world is sufficient.

Radial Light

Let's add a radial light. Click on the word Radial to choose the option. Look underneath to the box that says Distance of Balanced Illumination. This box indicates the strength of the added light. "Distance of balanced illumination" is the distance at which the light's rays strike objects without saturating the object or affecting the object too little. In other words, it is the perfect distance of the light from your objects. If the light is moved closer to the objects, the objects will appear saturated with the light's color. If the light is moved further away, the objects will appear less, or not at all, affected. The default distance is adequate for our needs. Click Add and then click Done. Be patient while the image is being redrawn to include the new light.

After the image redraws, the new radial light will appear directly in front of our camera. Its distance from the camera is the same distance as from the Anchor to the camera. It has a default color of white and is placed in the "Lights" group along with the other lights. A radial light appears as a small, simple ball.



(The radial light spreads light outwards from its location.)

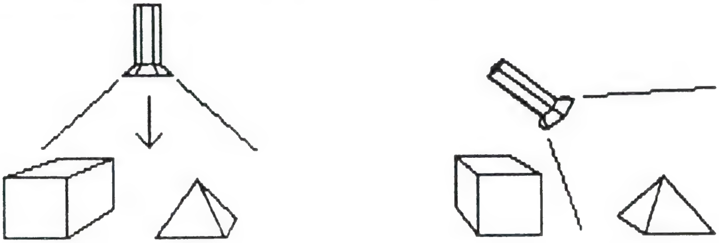
Notice how the radial light affects all of the objects around it. The world probably appears saturated with this new, white, radial light. Move it to a different location and see how it affects the objects. The objects will appear lighted from the new position. Rotate the radial light. Changing the orientation of a radial light doesn't affect the lighting of the objects. (Why? Because radial lights emit light in all directions, its orientation is unimportant.)

Creating Highlights

Suppose we wanted to make a highlight fall on a particular object's surface. We would use the Create Highlight function in the Object menu. This function requires a small setup before it can be used. First we need to select the light that will create the highlight. Select the radial light. Now select the object that will receive the highlight, like the right cone. (Remember to hold down the Shift key when using the Select tool to select multiple objects.) Select a surface on the right cone. (Remember to hold down the Command key to select surfaces.) From the Object menu, choose Create Highlight. After the image redraws, you'll see that the radial light has repositioned itself and a highlight appears on the surface. The Create Highlight function works with any kind of light except the ambient light.

Spotlights

Spotlights are the last of the four types of lights that a world can be illuminated with. Spotlights emit light in a particular direction. The light's influence is limited to an imaginary cone extending from the spotlight. Moving and rotating a spotlight affects the lighting of the world's objects.



(A spotlight limits its influence to a cone of light.)

Before adding a new light, let's turn off the Display as Solids mode from the Image menu. While this isn't necessary, it's practical because the new light will need to be repositioned and reoriented after it's added. As you know, changing a light will cause the image to be redrawn, and that can take time. So if you haven't already done so, choose Display as Lines from the Image menu. Also, unselect any selected objects.

Let's now add a spotlight. From the Object menu, choose Add Lights. When the dialog box appears, click on the Spotlight option. The spotlight has an additional box labeled Cone Angle. This determines how wide the imaginary cone of light will be. We can leave this set to its default value. The Distance of Balanced Illumination box can also remain at its default value. Click Add and then click Done. The new spotlight will appear directly in front of our camera. Spotlights have long body with a flared end; light emits from the flared end.

How would we make the spotlight point at the left cone? There are two ways. The first way involves the Anchor, and the second way involves making the spotlight the current camera.

To point the spotlight at the cone using the Anchor, the Anchor should first be made visible. Make the Groups window frontmost. Find the "Anchor" group and click under the eye icon to make the group visible. The blue Anchor object will appear in the middle of the World window. Make the World window frontmost. Select the left cone and then choose Position Anchor from the Align menu. The Anchor moves to the middle of the cone's bounding box. Select the spotlight so that only the spotlight is selected. From the Align menu, choose Orient to Point at Anchor. The spotlight is now pointing at the Anchor and the left cone.

To see the effects of the spotlight, choose Display as Solids from the Image menu. (Note that the Anchor is not drawn in the Display as Solids mode. This is because the Anchor is composed of lines and the Display as Solids mode only draws surfaces, not lines.) If the world is too bright with all of the lights, you can delete some, or you can make them black. Making a light black effectively turns the light off. Make the radial light black.

The spotlight can be pointed a second way. First change the display mode back to Display as Lines so that the world doesn't take too long to draw. Select the spotlight so that only the spotlight is selected. From the Camera menu, choose Make Object Current. The world is now being viewed from the spotlight. In fact, the spotlight is now the current camera and any function that works with the current camera will work with the spotlight. Think about that for a second. It's a powerful feature if used to its full extent.

The large circle in the World window represents the spotlight's cone of light. Objects that fall within the circle are within the spotlight's influence. The spotlight's cone is actually equal to the field of view. From the Camera menu, choose Field of View. A dialog box will appear. Set the box to 45 for a forty-five degree field of view. Click OK. Notice that the circle stays the same size but less of the objects fall within it.

The color of the circle represents the color of the spotlight. Because the current camera can't be selected, which in our case is the spotlight, there is a shortcut for directly setting the current camera's color. Holding down the Control key while clicking on a color in the palette sets the color of the current camera. Try making the spotlight orange.

The spotlight is aiming directly at the left cone, but the spotlight is tilted with respect to the Ground. From the Camera menu, choose Untilt to Ground. The spotlight is now level with the Ground. How would we point the spotlight at the right cone? From the Camera menu, choose Point at Objects. A dialog box of object names should appear. (If it doesn't appear, then an object was already selected and the spotlight pointed at it. Choose Undo, unselect all objects, and try again.) From the list, highlight the "cone upright" name. Click OK. The spotlight is now pointing at the other cone. If the spotlight is tilted, choose Untilt to Ground.

To see the effect of the spotlight on the object, choose Display as Solids from the Image menu.

How would you reposition the spotlight to aim at a different side of the cone? Because the spotlight is the current camera, we can use the Camera tool to rotate the spotlight around the cone. First select "cone upright" because that is the object we want to rotate around. Next, highlight the Rotate tool and then highlight the Camera tool; both tools should be selected. Click and drag the mouse anywhere in the World window to rotate the current camera around the cone. After the image redraws, the spotlight will be at a different position and orientation. As an exercise, how would you move the spotlight closer or further away from the cone? Hint: Look in the Camera menu for the simple solution, but there's an interactive way too.

Make the Main camera the current camera again; choose Main from the Camera menu. You should also unhighlight the Camera tool so as to prevent from accidentally rotating the current camera.

Lights and Animation

Because lights are objects just like any other kind of object, lights can be animated. If you wanted to animate a light's color, you could simply change the time and then set the light's color. The same applies to moving or rotating a light. Keep in mind that the Create Highlight function moves and orients the chosen light, which could animate the moving and orientation if you had previously changed the time. To prevent these kind of animation accidents from occurring, you should always animate the world's objects after everything has been composed properly. If that's not your style, at least get into the habit of looking at the current time before making any change. This way you'll begin to automatically think, "Will I be animating this object at this time?"

Lights can also be linked to other objects. For example, you could link a few radial lights to your central object so that the central object always is lighted, even if it moves.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

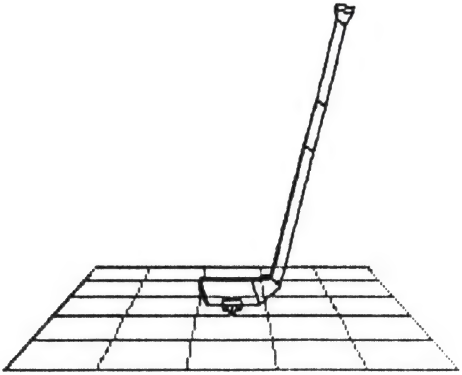
Tutorial Twelve, Part A: Animation

Animation should be the last step after building the models in your world. And if you plan to create anything but a simple animation, you should sketch a storyboard. A storyboard gives you a structured plan to work from, which is invaluable when you can get lost in a myriad of details. This tutorial will focus on creating a simple animation that demonstrates techniques you can use in longer and more complex animations.

Basic Techniques of Animation

The most straight forward way to animate an object is to set the time and change the object. We'll create a simple animation using this technique.

Open the project file "Tutorial.12a." When the World window appears, you'll see a hockey stick and a hockey puck. We'll animate the hockey stick hitting the puck and we'll make the camera move down to meet the onrushing puck. The puck is yellow and not black so that it doesn't blend into the background. If you want to change the color of the puck and the background, do so now.



Review

An object has thirteen different attributes that can be animated. Position, Orientation, Size, and Body Color are the four most common. The Move tool will modify an object's Position attribute. The Rotation tool will modify an Orientation attribute. The Size tool will modify a Size attribute, and clicking on a color in the palette will modify a Body Color attribute. Remember that you can not only change an object's attributes with the just mentioned tools, but also with the menu functions that appear *italicized*. Menu items that aren't italicized, like most of the items in the Appearance menu, have no corresponding animatable attribute and therefore can't be animated.

The current time is the most important thing to be aware of when creating animations. "What is the current time?" is the question you should ask yourself *before* changing an object. When an object is created, all of the object's initial attributes are put at the current time. Most of the objects you will make will be created at 00:00.00. In fact, if you look at the timeline, you'll notice that there are black attribute markers for all of the standard objects at 00:00.00. The objects will begin animating at 00:00.00.

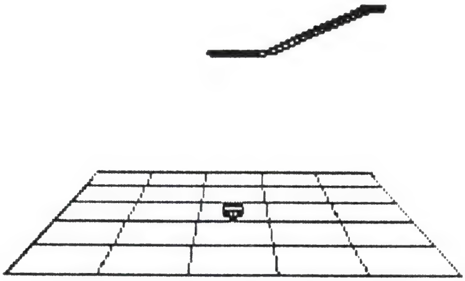
Hockey

The first part of the animation will be the hockey stick swinging back, pausing, and then swinging down to hit the puck. The second part will be the puck sliding forward while the camera moves down to greet the puck. This small animation will demonstrate a few simple, but important, concepts that will help you in your animation efforts.

Part One

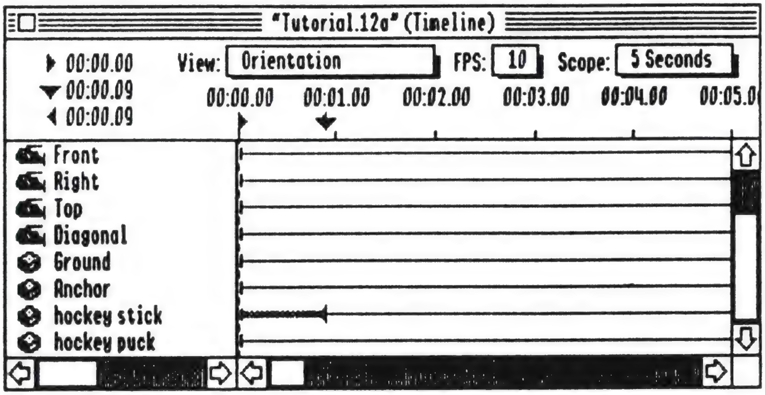
For an animation that's based upon reality, it's best to time the action as closely to life as possible. We want the animation to look correct. We will also want to use a frame rate that's close to our level of timing. Make the Timeline window frontmost. Click on the word FPS and choose 10 to set ten frames per second.

Make the World window frontmost again. The hockey stick's orientation is already where we want it to be at the current time of 00:00.00. Set the current time to 00:00.09. (That's nine-tenths of a second.) At this time, we want the hockey stick to be at the top of it's backswing. Select the hockey stick and then highlight the Rotate tool. Rotate the hockey stick backwards so that it is almost level with the Ground. You can do this by clicking and dragging the mouse in a downward direction. It may help to hold down the Shift key while dragging so that the rotation is constrained in a straight motion. If you make a mistake, you can always choose Undo and try again.



Tween Markers

We have just created a new Orientation attribute for the hockey stick at the current time of 00:00.09. Let's examine it briefly. Make the Timeline window frontmost. Scroll down to the bottom of the list where the hockey stick's name is located. Where is the attribute marker? Are we looking at the correct kind of attribute? No. The view is set to Position. Click on the word View and change the View to Orientation. You'll now see a blue bar next to the hockey stick's name. The blue bar is called a Tween and it signifies that all the in-between orientations between the two attribute markers will be generated automatically. At the left end of the Tween is a green triangle. This is a Start Tween marker. This marker signifies the orientation of the hockey stick at 00:00.00. At the right end of the Tween is a red triangle. This is a Stop Tween marker. It signifies the orientation of the hockey stick at 00:00.09. The Tween, or blue bar, was created between these two markers for us automatically. (Why? The Auto-Tweening feature is enabled by default, and at any time a new attribute is created, a Tween is extended from the previous attribute to the new one.)



"Tutorial.12a" (Timeline)

▶ 00:00.00
▼ 00:00.09
◀ 00:00.09

View: Orientation

FPS: 10

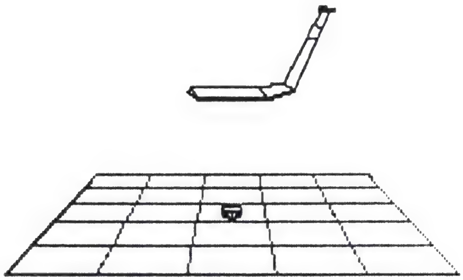
Scope: 5 Seconds

Now that the hockey stick swings back, we want it to hold its orientation briefly. With the Timeline window still frontmost, we'll set the current time to 00:01.01. We could do this by choosing Set Time from the Animation menu, but there is a more intuitive way. Drag the Current Time marker, the black triangle, from 00:00.09 to 00:01.01. (There are two black triangles. The one at the upper left corner of the Timeline window is just an indicator of the current time and will do nothing if you click on it. The clickable black triangle is above the large box and partially obscured by the red triangle. Don't move the red triangle, but if you do, choose Undo and try again.) Verify that the Current Time indicator at the upper left corner of the window says 00:01.01. If you are having trouble with this, you can still use the Set Time command from the Animation menu.

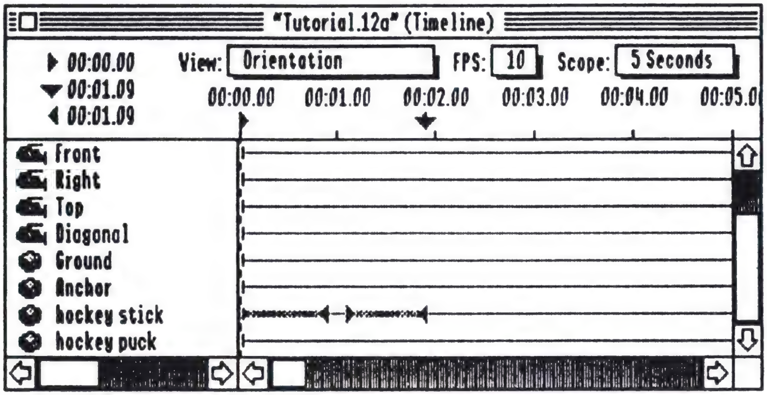
Creating New Attributes

With the current time at 00:01.01, choose Mark Object Orientation from the Animation menu. (Remember that the hockey stick is still selected in the World window.) A black Rest marker will appear at the current time for the hockey stick. The Rest marker is a new Orientation attribute. This Orientation attribute is a copy of the of the previous orientation attribute. The reason why a new attribute was created will be evident in a moment.

Make the World window frontmost. Set the current time to 00:01.09. Rotate the hockey stick so that it swings forward. It should end up at the top of its forward upswing, which is almost parallel to the Ground. (Don't swing the stick too high, not only because it's frowned upon in hockey, but for another not so obvious reason. The hockey stick should swing less than a half-circle. If the swing is more than a half-circle, then the shorter route of the circle would be taken, which would be over the top.)



Make the Timeline window frontmost. Notice that there's a second Tween for the hockey stick. The Rest marker that we created using the Mark Object Orientation command has been automatically transformed into the Start Tween marker of the new Tween. The Stop Tween marker, red triangle, is the new attribute that was created from rotating the object. Notice the space between the two Tweens. That space represents the pause that the hockey stick holds between the end of its backswing and the beginning of its downswing. If we had not used the Mark Object Orientation command, the attribute created by the Rotate tool at 00:01.09 would've extended the first Tween into one long Tween of three attributes. The resulting action would be a hockey stick swinging back and then immediately swinging forward.



"Tutorial.12a" (Timeline)

▶ 00:00.00
▼ 00:01.09
◀ 00:01.09

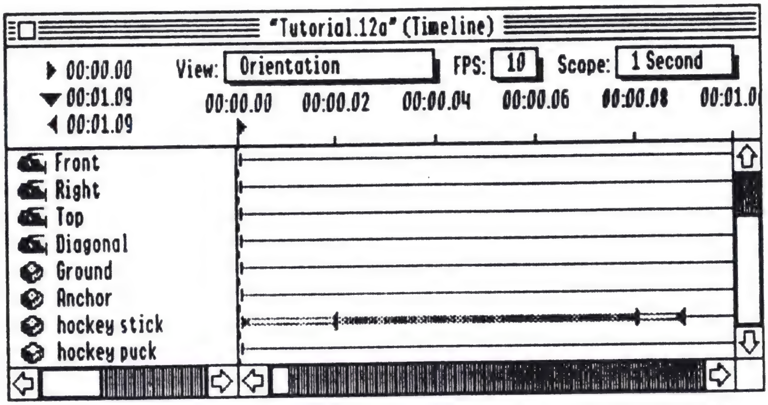
View: Orientation FPS: 10 Scope: 5 Seconds

Create a test animation to see the action of the swing. From the Animation menu, choose Animate to Window and then click OK to accept the default settings. The stick will swing back, pause, and swing down and through. (So far, two things could go wrong with the animation. The first is simple to identify. If the animation stops before it should, check the Stop Time maker in the Timeline window. It's the red triangle at the top of the large box and should be set to 00:01.09. The second problem would involve the rotation of the hockey stick. If instead of swinging down, the hockey stick swung over the top, then your start and stop swinging orientations weren't low enough. In other words, if the route between one orientation and the next is greater than a half-circle, then the shorter path of the circle is taken. There are a few solutions. The most obvious is to adjust the orientations at the beginning and ends of the Tween so that the route between the orientations is less than a half-circle. The other solution would be to keep the two orientations the way they are. At 00:01.05, a new orientation is created where the stick is in the middle of the other two orientations but pointing downward. The resulting animation would make the hockey stick swing down to the middle orientation and then back up to the ending one.)

Adding Acceleration and Deceleration

Let's add acceleration and deceleration to the hockey stick's swing. Make the Timeline window frontmost. We want to make the first part of the swing go back slowly and slow down just a little before stopping to pause. Click on the first Tween which represents the backswing. The Start Tween and Stop Tween markers of the Tween will appear bright green, indicating that they are selected. This is one way of selecting markers. (Dragging a box around markers will select any marker in the box. Or clicking individually on the markers selects one marker at a time. For now, just select the two makers of the first Tween.)

From the Animation menu, choose Add Accel / Decel to Tween. You'll see two new markers added to the Tween. These are the Acceleration and Deceleration markers. We'll want to see the Tween more closely. Click on the word Scope and choose 1 Second. The Tween appears larger because we've magnified the amount of time that is displayed. You'll notice that parts of the blue Tween has white in it. This white indicates the acceleration and deceleration zones. The length of the first zone, acceleration, appears to be correct, but the deceleration would take too long. Let's shorten it. Click on the Deceleration marker to select it, and then drag it so that it's under the 00:00.08 time. This way, the hockey stick will slow down relatively quickly.



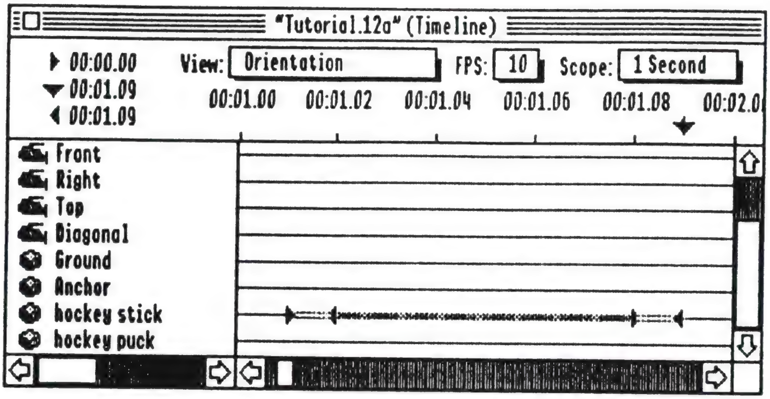
"Tutorial.12a" (Timeline)

View: Orientation

FPS: 10

Scope: 1 Second

Use the long scroll bar at the bottom to scroll ahead one second in time. The second Tween should be in view, which represents the forward swing. Repeat the same steps to add Acceleration and Deceleration markers to the second Tween. (Select the Start and Stop Tween markers. Choose Add Accel / Decel to Tween.) The new Acceleration zone is too long, which would make the stick take too long to swing down. Move the Acceleration marker to 00:01.02 so that the hockey stick will speed up quickly. The Deceleration marker could be moved up so that the deceleration zone is smaller. Move it to 00:01.08.



"Tutorial.12a" (Timeline)

▶ 00:00.00
▼ 00:01.09
◀ 00:01.09

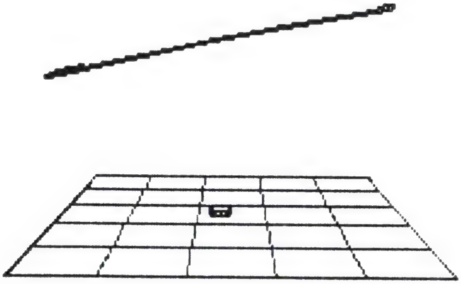
View: Orientation
FPS: 10
Scope: 1 Second

Create a test animation to see the results. The effects of acceleration and deceleration will be a bit hard to discern because we are still at a relatively low frame rate of ten frames per second. Increasing the frame rate, which we'll do for the final animation, will make the changes more noticable.

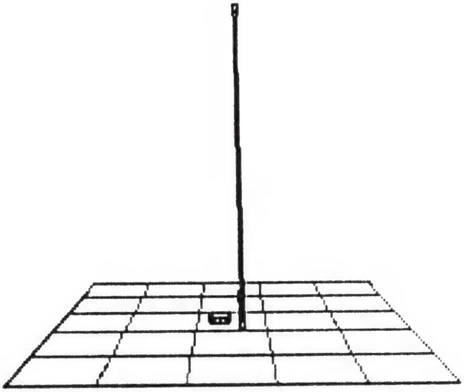
Part Two

The hockey stick now animates as it should. What remains is the puck and the camera. We'll do the puck first.

We have to determine at what time the hockey stick meets the puck. At that time, we will animate the puck moving forward. With the World window frontmost, go to the Camera menu and choose Right. From the Right camera's view, it will be easier to determine the exact moment of the impact. (You can unselect the hockey stick; we won't be changing it anymore.)

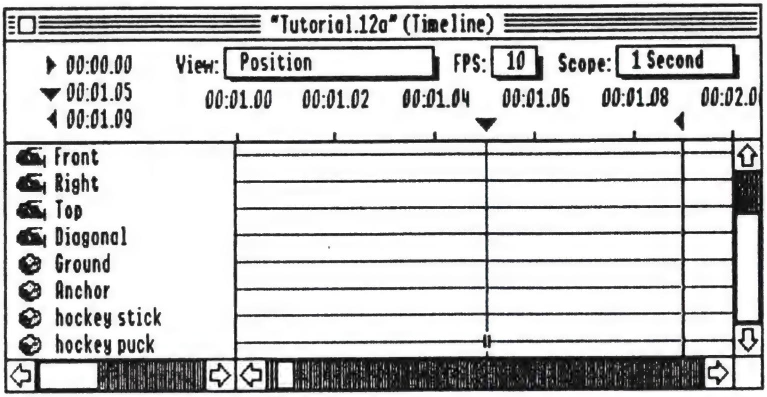


To determine the time of impact, step backwards through time by frames. An easy way to do this is to click on the hollow left triangle next to the current time. Stop when the hockey stick meets the puck. It should be around 00:01.05. If the stick doesn't exactly touch the puck, you could ignore it or go to a higher frame rate to find the precise time. For our purposes, we don't need the precise time.



(The hockey stick at 00:01.05.)

We want to make the puck begin moving at the time we determined from the previous step. (For illustration purposes, let's assume that it's 00:01.05.) How do we make the puck begin animating at this time? First select the puck. From the Animation menu, choose Mark Object Position. A Position attribute has been created at 00:01.05. We will animate from this position. If we didn't create a Position attribute at this time, the puck would animate from its first Position attribute, which is at 00:00.00. That wouldn't look correct. To verify the new Position attribute, go to the Timeline window. Set the View to Position to see the Position attributes. You should see a black Rest marker at 00:01.05 for the hockey puck.

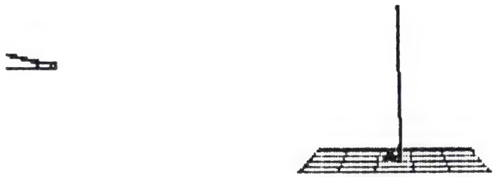


"Tutorial.12a" (Timeline)

▶ 00:00.00
▼ 00:01.05
◀ 00:01.09

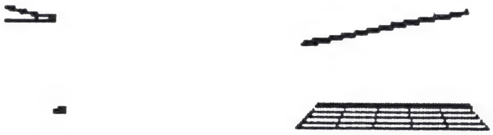
View: Position
FPS: 10
Scope: 1 Second

Since we want to have the hockey puck hit the Main camera, we want to know just where the Main camera is located. The cameras are hidden by default. Make the Groups window frontmost. Find the "Cameras" group and click in the vacant space under the eye icon. This will make all the cameras visible. However, we won't see the Main camera yet because the Right camera is too close to the scene. From the Camera menu, choose Move Out. Don't worry that we might be animating the movement of the Right camera—we won't. Since the editing cameras (Front, Right, Top, Diagonal) are used only for editing purposes, they cannot be animated.



Now that we've moved backwards, we can see more of the scene. At the very left of the window, you should see the Main camera. You may have to scroll the World window's horizontal scroll bar to see it. If you doubt that the white object at the left of the window is the Main camera, choose Names from the Object menu to display the objects' names.

Now that we know where the Main camera is, we can slide the puck to the foot of the camera. We'll later make the camera drop to the puck's level. Before we move the puck, check the current time. It needs to be set to the time when the puck hits the camera. Set the time to 00:02.05. The hockey stick will now appear raised because the time is past its last orientation. With the puck still selected, move it to the place right under the camera. To constrain the puck to a straight movement, hold down the Shift key while dragging the puck to its new position.

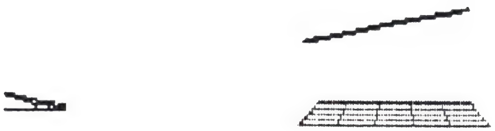


Go to the Timeline window. Set the Scope to 5 Seconds so that the puck's entire Tween can be seen. Because the puck travels rapidly from its initial start and doesn't slow down, we don't need to add acceleration or deceleration.

Go to the World window and create a test animation. From the Right camera, you should see the hockey stick hitting the puck and the puck travelling toward the Main camera.

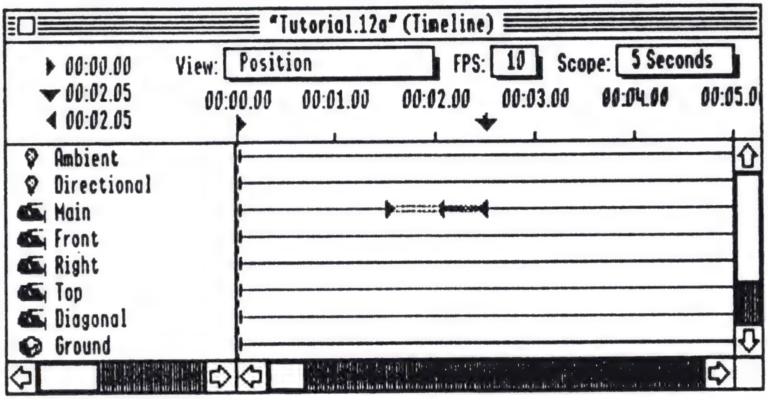
The final step is to make the camera move downward. What time will the camera begin moving down? How about when the puck is hit? That begins at 00:01.05. So set the current time to 00:01.05. Select the Main camera, which is still at the left side of the window, and choose Mark Object Position from the Animation menu. (Don't choose Mark Camera Position because that relates to the current camera, which is now the Right camera.)

Set the current time to when the puck reaches the camera, which is 00:02.05. With the Main camera still selected choose Position to Ground from the Align menu. The Main camera will drop down to the Ground, which is the same level as the puck.



Did the movement of the Main camera become animated? Go to the Timeline window to find out. Scroll to the top of the list of object names to where it says Main. Yes, you'll see a Tween for the Main camera, indicating the camera will automatically move between the two positions. The Position to Ground command animated the movement of the Main camera. The command, like many other menu commands, can animate objects. To help remember which commands can animate objects and which commands can't, the ones that are *italicized* can animate objects.

And finally, let's add a bit of acceleration to the Main camera's descent. Select the Tween's two markers. From the Animation menu, choose Add Accel / Decel to Tween. We only want the acceleration but not the deceleration. How do we delete the Deceleration marker? First select the Deceleration marker so that only the Deceleration marker is selected. To do this, just click on the marker and not the Tween's blue bar. (The Deceleration marker is the next-to-last marker.) Press the Delete key. The marker is removed. If you want to change the length of the acceleration zone, click and drag the Acceleration marker to a new time. Note that if you drag the marker outside of its Tween, then the Acceleration marker will be automatically deleted. (Why? Acceleration and Deceleration markers are only valid when inside a Tween; they have no use outside of a Tween. If you accidentally move one of these markers outside a Tween and the marker is deleted, you can always choose Undo.) For purposes of illustration, suppose we move the Acceleration marker to a point about half way in the Tween. The camera will slowly accelerate, continue at an even pace, and then suddenly stop when it reaches the Ground.



View: Position FPS: 10 Scope: 5 Seconds

Create a test animation. If all the objects animated on cue, then we're set for our final animation. If there's a discrepancy, you'll have to go to the time where the trouble first begins. Use the timeline to analyze the attributes' timing. The typical procedure is to set the current time to the time of an attribute. Go to the World window to see the object. If the object is correct, go back to the timeline and set the current time to the next attribute in question. Continue until the culprit attribute has been found. If the attribute was created by accident and doesn't belong, you can delete it. If the attribute is just plain wrong, you can use one of the tools to change the object, which will change the setting of the attribute. As a last resort, an object's attribute markers can be deleted and you can restart over again.

Final Animation

We can create an animation using any camera, but now that we're making the final animation, we want to look through the camera that's animated. Make the Main camera the current camera. From the Camera menu, choose Main. Let's also increase the frame rate to thirty frames per second. We were previously animating at ten frames per second and the movements were somewhat jerky. A higher frame rate will show smoother movements. Go to the Timeline window. Click on the word FPS and choose 30. Make the World window frontmost. From the Animation menu, choose Animate to Disk. Set these options: turn on Solids, turn off Shading, set 320 x 200 Pixels, and turn on Optimize. Click OK. A standard save dialog box will appear. Find a place to save the resulting animation. It will be about 70K in size. Click Save. The animation will draw each of the seventy-six frames, saving them all as one animation on disk. When it's done, an Animation window will appear on the desktop. Click on the Play button. The animation of the hockey stick will play back, but at a real-world rate of thirty frames per second. You can speed up or slow down the animation while it's playing by pressing the arrow keys. Clicking the mouse or pressing any other key will stop the animation.

Animate to Disk Options

When animating to disk, the Animate Options dialog box has several additional choices that are available to us. Two of them are the 320 x 200 and the 640 x 200 Pixels options. If you will be using your animation in HyperStudio, be sure to set the 640 x 200 option. HyperCard IIGS can use either setting. See the Reference section concerning the Animate to Disk command for further instructions on integrating your animations into HyperStudio.

The advantage of using 320 x 200 Pixels is that you have an additional option called Optimize. If you turn on Optimize, your animations will play faster and use less disk space than if Optimize is turned off. Optimize takes advantage of a special feature of the Apple IIGS called "Fill Mode" video. Fill Mode assures fast and compact animations, although its use is defeated when the image is displayed as lines. Turn off Optimize when displaying as lines or when you want to use the GS' normal video. In general, you'll want to keep Optimize turned on when displaying as solids.

Tips for Smooth Animation Playback

It will help to know how animations are stored on disk. Whenever there is a change from one frame to the next, only the changed part is recognized and saved. Frames that change little from frame to frame play back easily. However, frames that change a lot, usually resulting from moving or rotating the camera, make the playback work harder. The animation may not play smoothly and the animation's file size may balloon.

Exercise

The hockey stick animation can be improved upon. For instance, after the animation plays, it immediately loops back to the beginning. It would be simple to extend the length of the animation so that the camera's position holds for a second. Hint: This involves the Stop Time marker in the Timeline window.

You could get fancy and make the camera suddenly tilt and spin when it gets hit. You could make stars spin around or make teeth fly. Be creative. If you decide you want to come back to this task later, save the project, but use a different name. From the File menu, choose Save As. If you do decided to add your own personal touches to this animation, you will have reanimate the animation to disk. There is currently no way to append to an animation.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Twelve, Part B: Animated Keys

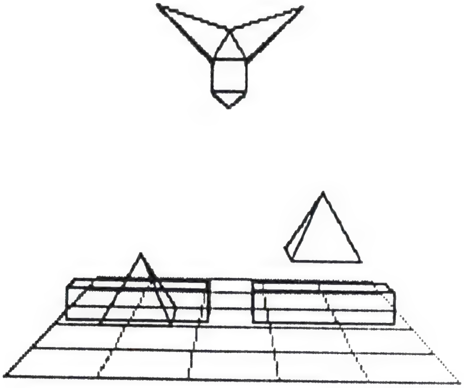
At first glance, the easiest way to animate an object is to set the time and change the object. By making many related changes at different times, you create an animated action. However, there is one major drawback to this method: you can't reuse your actions with different objects. For instance, suppose you wanted to make a ball bounce. That's easy enough. But what if you later realize that you want to make your name bounce? What would you do? You would think you would have to create the bounce action all over again.

Inheritance of Actions

However, there is a better way to reuse actions. The process involves linking. Remember linking? Linking is where one object is attached to another to create a parent-child relationship. The child then inherits the position, orientation, and size of its parent. Can you already see how this will work with animation? So instead of creating a bounce action separately for a ball and then again for your name, you would create a different object called a *key*. This key object is the only object that bounces. You would then link your name to the key and your name will bounce along with the key.

Linking is a powerful tool when used with animation. For instance, many objects could be linked to one key and all of the objects would bounce along with the key. Keys can even be linked to other keys which layers the keys' actions. For example, if you wanted the bouncing name to move, you would link the bouncing key to a moving key. If this seems a bit abstract and hard to visualize, that's okay because this tutorial will focus on animating with keys.

Open the project file "Tutorial.12b." When the World window appears, you'll see several objects. The object near the top of the window is the object we will be animating; we'll call it the "shape" for lack of a better name. The objects on the Ground are the keys which will animate the shape.



Keys

Keys are simply objects that have specific animated actions. The keys in this world are the two pyramids. Keys are usually given bright colors to distinguish them from the other objects in the world. You'll also notice that with each pyramid is a rectangular box. This is the key's parent, which is called the *master key*. The master key generally does not animate because it serves as a base from which the key animates. In other words, you can move the key and its entire action just by moving the master key. If the key didn't have a master and you wanted to move the key to another location, you would have to readjust all of the key's individual Position attributes. Think of the master key as the base from which the key's action's originate.

The left key is a spinning key. It's called a spinning key because its action appears to spin. It simply spins one complete rotation every two seconds for one minute.

The right key is a bouncing key. Its action is simply to bounce up and down every second for thirty seconds. This is the more complex of the two keys because its action squashes and stretches, which gives it a natural look.

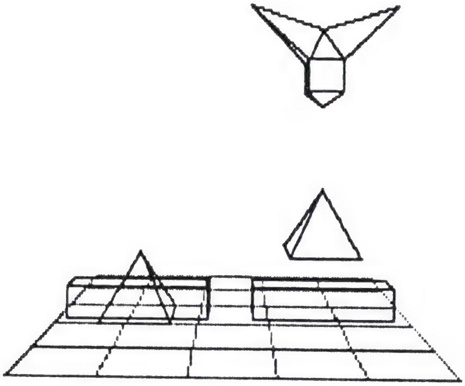
Let's animate the keys to see their actions. From the Animation menu, choose Animate to Window. Click OK to accept the default settings in the Animate Options dialog box. The key objects will animate for two seconds of time at ten frames per second. The left key, the spinning key, just twirls around for one complete revolution. The right key, the bouncing key, bounces twice. The shape doesn't do anything because we haven't animated it yet.

If you're curious, look at the Timeline window to see the keys' attributes spread over time. The spinning key just repeats the same four Orientation attributes for sixty seconds. The bouncing key repeats a set of Position and Size attributes for thirty seconds. Even if you do not make a sixty or thirty second animation, the extra attributes are there if you need them. If you don't need the attributes, you could delete the excess, but don't do that now. When you're done looking, make the World window frontmost again.

Linking Objects to Keys

How do we make the shape bounce? We need to link the shape to the bounce key. The first thing we should always do before making any changes to the animation is to look at the current time. Right now, it's set at 00:02.00 because that's when the animation stopped. Reset the time to the beginning of the animation, which is 00:00.00.

Move the shape to the right so that it is above the orange pyramid, or bounce key. Before we link the shape to the key, we should preset one of the shape's options concerning inheritance. With the shape still selected, go to the Appearance menu and choose Inherit Position From Size to uncheck this option. We are telling the shape not to reposition itself when its parent-to-be, the key, resizes itself. Not all keys resize themselves, but the bounce key resizes when it stretches and squashes.

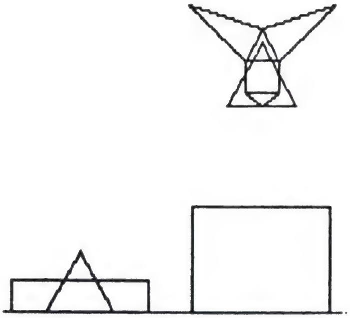


We can link the shape to the key now. Highlight the Link tool, which is below the Rotate tool. Always link from the child to the parent, which in this case would be from the shape to the bounce key. Click on the shape and drag to the bounce key (the orange pyramid). After linking, remember that the Link tool is still highlighted. Sometimes it's a good idea to highlight another tool, like the Select tool, so that the Link tool isn't used accidentally.

Choose Animate to Window to see the result. Was it what we expected? No. Although the key bounced on the Ground, the shape stayed above the key. We can correct it. First, go back to the beginning of the animation by resetting the time to 00:00.00. (Choosing Undo does the same thing because animating changes the current time.) We could move the shape down so that it's on top of the key, but then the shape would only bounce a small height. How do we make the bounce key go higher? We could individually change the key's Position attributes, but that is out of the question because it's too difficult. The solution is resize the master key, the orange box, to be taller, which will in turn raise the height of the bounce. (Why? The key inherits its position from the master's size. If the master becomes taller, the key will move farther away, or higher, from the master.)

We need to unlink the shape before we change the master. This is necessary because the shape is a grandchild of the master and resizing the master will affect the shape, which is not what we want to have happen. Select the shape so that only the shape is selected. Click on the Unlink tool, which is to the left of the Link tool. The shape is immediately unlinked from its parent, the key.

Because we'll also need to align the objects, it is best to turn off the perspective. From the Camera menu, choose Perspective. Now select the master key, which is the orange box. Use the Size tool to stretch the master to be taller. You'll see the key move higher, which is what we want to have happen. Make the bottom of the key line up with the bottom of the shape. Then link the shape back to the key with the Link tool. (Remember to link from the child to the parent, or the shape to the key.) Choose Animate to Window to see the results. Keep the perspective mode off.



Did the shape bounce correctly? Almost, but not entirely. It did bounce from the proper height. However, if you looked closely, you saw that the bottom of the shape didn't squash against the Ground like the key did. Why not? From the Object menu, choose Centers to view the objects' centers. Aha! Notice that the key's center is at its bottom, but the shape's center is in its middle. The shape's center should be at its bottom. (Why? When an object resizes, it resizes about its center. Putting the center at the bottom of the shape will make the shape stretch from its bottom.) The solution is to move the center to the bottom of the shape. Before we do that, check the current time. Is it at the beginning of the animation? No. Reset it to 00:00.00. Select the shape so that only the shape is selected. With the Select tool, Option-click on the shape's bottom-most point to select it. From the Object menu, choose Recenter. The center is moved to the selected point. (Note that recentering an object actually changes the object's position. By keeping track of the current time, we won't animate that change of position.) Try reanimating again. The shape bounced the way it should.

We could've avoided these troubles if we had planned ahead. The bounce key is more demanding than other keys, which have much simpler actions. In general, you should follow these steps before linking an object, or objects, to a key:

- Decide which attributes you want the object to inherit from the key. Enable or disable the appropriate Inherit... items in the Appearance menu.
- Ensure that the center is where it should be so that the object will pivot and size correctly.
- Align the object properly in relation to the key.
- After linking, do simple test animations to verify the results.

Linking Keys to Keys

By linking one key to another, the action of both keys is compounded. For instance, how would we make the shape spin while it's bouncing? We link the bounce master key to the spinning key. As always, look at the current time. Is it at the beginning of the animation? No. Set it to 00:00.00. Using the Link tool, link the bounce master key, the orange box, to the spinning key, the yellow pyramid. Turn the perspectiveness back on so that the spinning motion won't appear flat. Animate to see the results.

Did the shape spin while bouncing? Yes and no. The shape bounced but it circled around the spinning key instead of spinning in place. If this is the effect you wanted, then you're all set. However, how would we make the shape spin in place? There are two ways.

The first way is the obvious way, and we'll just explain it. We would first reset the time to 00:00.00. We would then move the bounce master, the orange box, so that it is directly over the spinning key. The shape would then spin in place. Resetting the time is mandatory because moving the bounce master would otherwise animate the move, and we wouldn't want that.

The second way is not so obvious, but it's the smart way. We don't have to reset the time because we're not actually modifying any attributes; we're just going to turn off one of the inheritance options for the bounce master. Select the bounce master, the orange box, so that only it is selected. From the Appearance menu, choose Inherit Position from Orientation to uncheck this option. The bounce master will no longer automatically move when its parent, the spinning key, rotates. Reanimate to see the results.

Did the shape bounce and spin at the same time? Yes. It now animates as it should and we didn't even have to directly animate the shape. All we did was link it to other objects that animate.

Now how do you hide those ugly keys? We don't want day-glo shapes detracting from the shape's animation. The keys have their own group, and hiding the group will hide the keys. Make the Groups window frontmost. Find the "keys" group. Click on the check mark under the eye icon. The keys are now hidden.

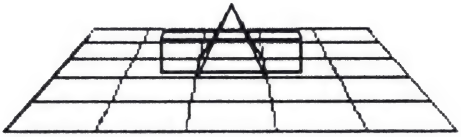
Make the World window frontmost again. For the final animation, we'll increase the frame rate to thirty frames per second. We were previously animating at ten frames per second and the bounce was somewhat jerky. A higher frame rate will show a smoother bounce. Go to the Timeline window. Click on the word FPS and choose 30. Make the World window frontmost. From the Animation menu, choose Animate to Disk. Set these options: turn on Solids, turn off Shading, set 320 x 200 Pixels, and turn on Optimize. Click OK. A standard save dialog box will appear. Find a place to save the resulting animation. It will be about 70K in size. Click Save. The animation will draw each of the sixty-one frames, saving them all as one animation on disk. When it's done, an animation window will appear on the desktop. Click on the Play button.

You've successfully finished another tutorial. You can practice some of the things you've learned on your own, or you can continue to the next tutorial. In either case, we won't need the world any longer. Close the World window by choosing Close from the File menu. A dialog box will appear asking if you want to save the changes. Click on Don't Save.

Tutorial Twelve, Part C: Creating Keys

Whenever an action can be repeated, it is a candidate for becoming a key. Keys can be exceptionally productive agents for animations that need repetitive actions. However, it should be pointed out that keys do not adapt well to other tasks, like a character acting out a role. For character animations, it is best to animate the parts of the character directly instead of indirectly with keys.

Open the project file "Tutorial.12c." Resting on the Ground is a key and its master. They have no animated attributes. This tutorial will focus on creating an animated key that can be reused.



Creating a Rocking Key

Suppose we're creating an animation where a few objects rock back and forth for several seconds. It may not be hard to directly animate the objects that rock back and forth, but if you ever need to reuse the rocking action, you'll be glad you made a reusable rocking key.

From an upright starting orientation, we'll make the key rotate clockwise for one second, stop, rotate counterclockwise for two seconds to the direct opposite side, and then spend one second returning to the starting orientation. The whole cycle will take four seconds. We can easily duplicate these attributes to make the rocking motion continue for as long as we'd like.

Begin by checking the current time. It should be 00:00.00. Command-click on the Rotate tool to display the Rotation Options dialog box. Make sure that the value in the Keypad Rotates box is set to 90. Ninety degrees is one quarter turn. Click OK.

The master, which is the box, does not animate because it serves as a base for the key. Select the key, which is the pyramid. Set the current time to 00:01.00. Then using your keyboard's keypad, press the 9 key. The pyramid rotates 90 degrees, or one quarter turn clockwise. Set the current time to 00:02.00. Press the keypad's 7 key. The pyramid rotates one quarter turn counterclockwise. Set the time to 00:03.00. Press the keypad's 7 key again. The pyramid is now pointing to the left. Set the time to 00:04.00. Press the keypad's 9 key. The pyramid is now back to its original orientation. The cycle is complete. Choose Animate to Window to see the results. The pyramid rocks back and forth. We've just created a key. We could now link other objects to it and they would rock back and forth.

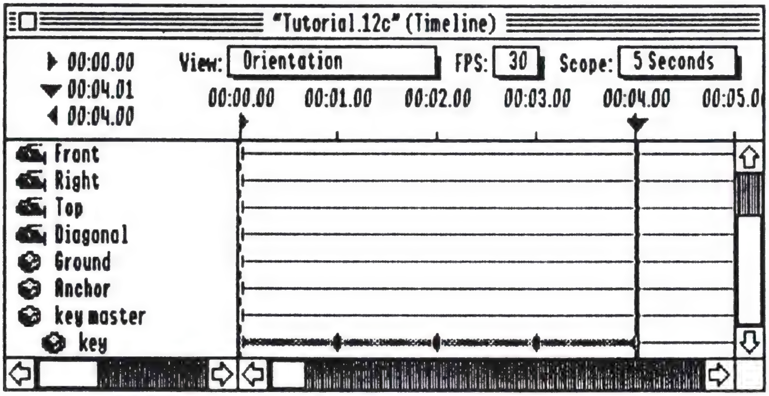
Duplicating Attributes

How would we make the key rock for three cycles instead of just one? We could certainly repeat the above steps two more times, but that would become tedious. There is an easier way. All we have to do is duplicate the key's Orientation attributes.

Before beginning to duplicate the attributes, we need to prepare the environment. First unselect all selected objects. Make the Timeline window frontmost. In our situation, we want to work with the highest frame rate possible. Click on the word FPS and choose 30. Now, scroll down until the key's name appears in the list. Where are the attributes markers? You can't see them because the View is set to only see the Position attributes. Click on the word View and choose Orientation. You will see the attribute markers for the key object. You should know by now that the blue Tween indicates that the in between orientations are automatically computed. We want to duplicate the five markers, which is the entire Tween, and place them beginning right after 00:04.00.

Follow these steps; their significance will be explained in a moment. Change the current time to 00:04.01. A quick way to do so is to click and drag the current time marker, the black triangle, to 00:04.01. (There are two black triangles. The one at the upper left corner of the Timeline window is just an indicator of the current time and will do nothing if you click on it. The clickable black triangle is above the large box and partially obscured by the red triangle.) Looking at the three time indicators at the upper left corner of the Timeline window, verify that the following times are set correctly:

- Start Time (green triangle) — 00:00.00
- Current Time (black triangle) — 00:04.01
- Stop Time (red triangle) — 00:04.00



"Tutorial.12c" (Timeline)

▸ 00:00.00
▾ 00:04.01
◂ 00:04.00

View: Orientation FPS: 30 Scope: 5 Seconds

If any one of these isn't correct, drag the appropriate time marker so that the above times match. What we've done is prepare for duplicating the attributes. We have to have some way of indicating which attributes to duplicate. We do so using the Start Time and Stop Time markers. Any attributes that lie between the markers will be duplicated. The Current Time marker determines where the duplicated attributes will be placed at. In other words, we've indicated that all of the attributes between 00:00.00 and 00:04.00 will be duplicated and placed beginning at 00:04.01.

From the Animation menu, choose Duplicate Attributes. A dialog box will appear with a list of all the object names. Highlight the "key" object and click OK. (If a dialog box didn't appear, it's because an object was selected in the World window and that object was used. Choose Undo, unselect the objects in the World window, and try again.) The Orientation attributes are duplicated and placed at 00:04.01. Scroll the bottom scroll bar to the right to see all the duplicated attributes. They end at 00:08.01.

We now have two rocking cycles for the key. We need to create one more cycle. The Start and Stop Time markers can be left alone. All we need to do is move the Current Time marker to 00:08.02. Do that now. Choose Duplicate Attributes again. Highlight the "key" object and click OK. The attributes are duplicated and placed at 00:08.02 and extend to 00:12.02.

Very good. You now have three rocking cycles. It would be a good idea to save this project for future use so that you can use the key in your own project. Save the project as a different file name using Save As from the File menu. This is how you build libraries of actions.

Let's test the use of the key. Go to the World window and select both the key *and* its master. From the Edit menu, choose Copy. Create a new project by choosing New from the File menu. Choose Paste from the Edit menu. A copy of the key and its master are now in the new project. Make an object—any object. It could be a simple square; it doesn't matter. With your newly made object still selected, go to the Appearance menu and choose Inherit Position from Orientation to uncheck this option. We don't want the new object to move when the key rotates. With the Link tool, link the object to the key, which is the pyramid.

Run a test animation to see the object rock back and forth. The animation will run for twelve seconds at three frames per second. For the first four seconds, the object will rock from one side to the other along with the key. But after that, the object doesn't appear to rock completely to either side. Why? The reason is because when we duplicated the attributes, we advanced them ahead by 1/30th of a second. If we were to animate at a higher rate, like 1/30th of a second, the object would appear to rock completely to either side. When you become more experienced in creating keys, you will recognize this ahead of time and be able tweak the timing of the attribute markers before duplicating them.

Congratulations!

You've successfully finished the full suite of tutorials. You should have a strong enough grasp of Animasia 3-D's concepts and tools to create your own objects, images, and animations. With your knowledge, there are two paths you can follow. The first would be to playfully experiment with the features and see what develops. The second would be to plan out a *simple* animation and then produce it. Don't try to make "Star Wars" on your first (or fiftieth) tries because it's too ambitious. Think along the lines of simplicity and clarity. What is it that you want to say?

If you get stuck at some point and can't figure out how to do something, look to the Reference section. It details all of the windows, menu items, and tools with many options and shortcuts that weren't covered in the tutorials.